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POPULAR MECHANICS MAGAZINE

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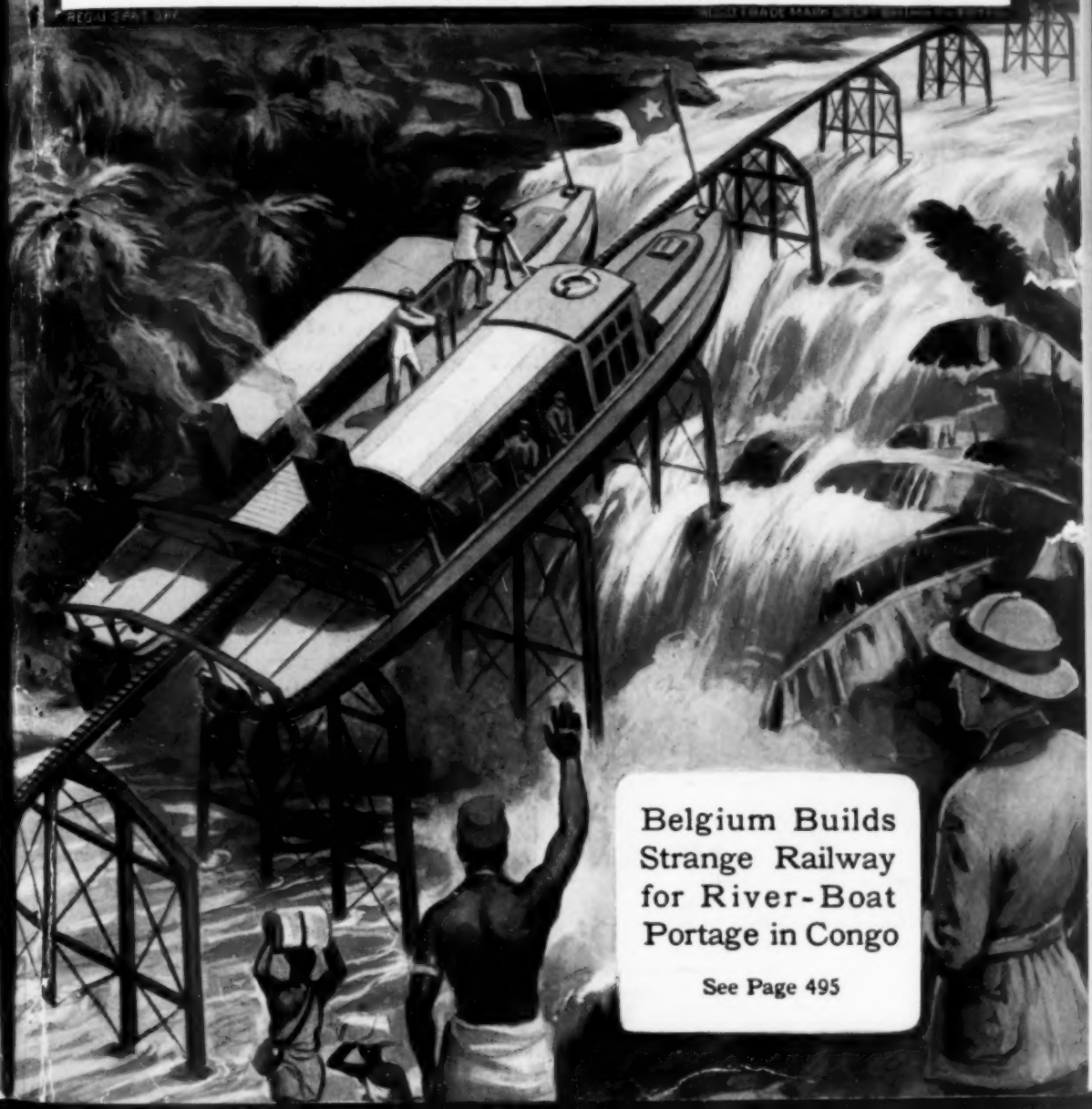
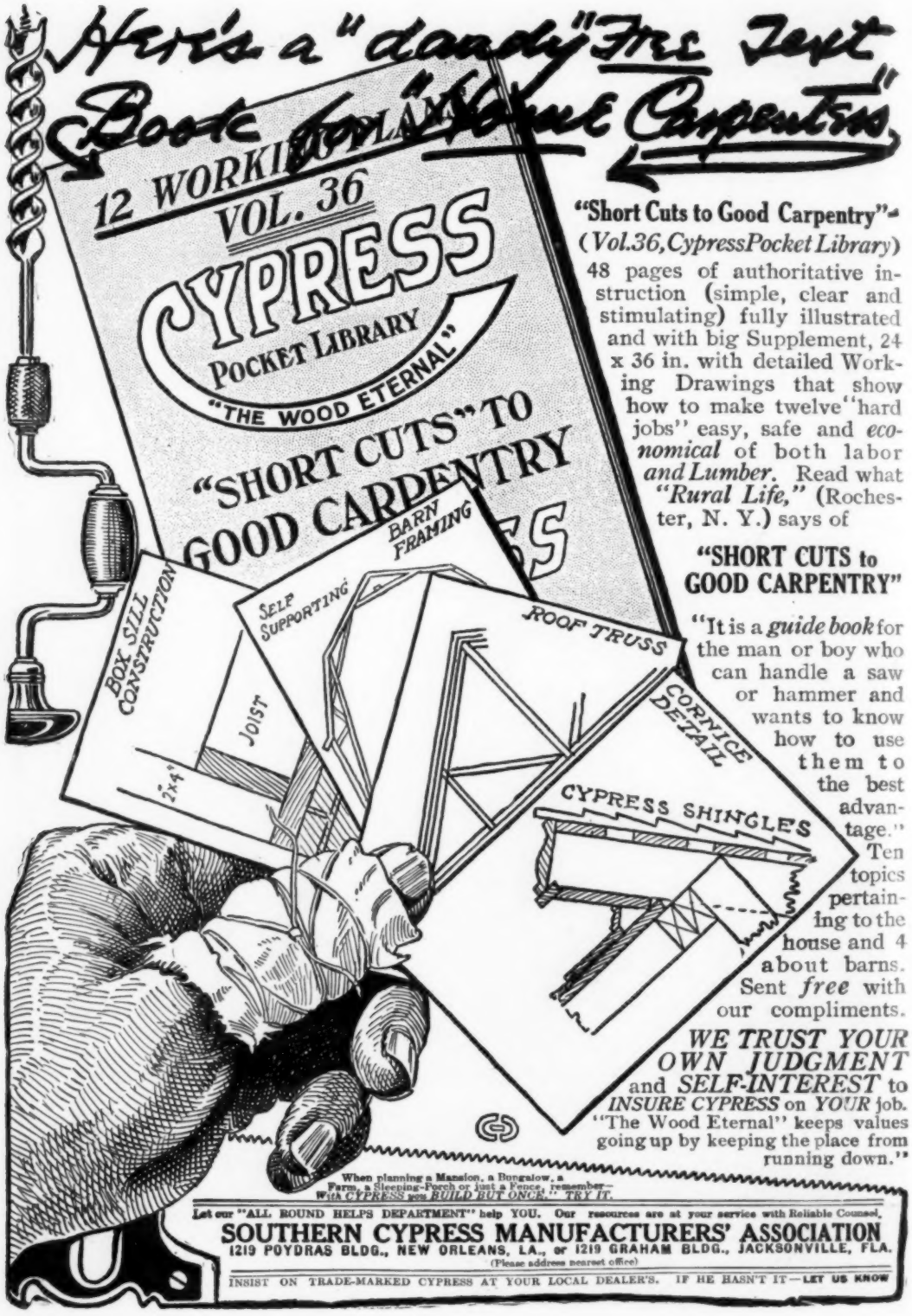


Belgium Builds Strange Railway for River-Boat Portage in Congo

See Page 495

Here's a "dandy" Free Text Book for "Home Carpenters"



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VOL. 36 OCTOBER, 1921 No. 4

Track Built under Water Tank to Move It

MOVING a steel water tank, 45 ft. high, is no easy matter, especially when that tank is 24 ft. wide and weighs 65,000 lb. Ordinary loading devices were never considered for the job, as it was an extraordinary one. The tank stood on concrete piers at Engle, N. M., and was to be moved to Cutter, N. M., eight miles away. In order to get it from its fixed position on the piers to the flat car assigned to haul it, it was jacked up and a track laid beneath. The flat car was then placed at the proper point under it and the jacks released until the tank reposed in an upright position on the car. An additional car loaded with slag ballast was hooked on between the engine and the tank carrier. The train thus formed,

A Track was Built under This 65,000-Pound Steel Water Tank, After Which It was Jacked Up from Its Foundation and Reset on a Special Flat Car. Two Hours and 15 Minutes were Required to Haul It from Engle to Cutter, New Mexico, a Distance of Eight Miles

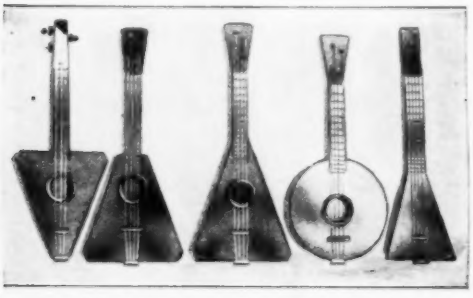
moved down the eight miles to Cutter in two hours 15 minutes. The ballast and carrier cars were tied together with heavy

A Rear View of the Heavy Tank Showing the Block and Tackle Application for the Prevention of a Capsize en Route

bridge stringers. The tank was steadied by block and tackle guyed from the top. Heavy bridge stringers laid crosswise of the carrier car were also provided in order to prevent a breakdown of the latter while on the road.

METAL STRING INSTRUMENTS FOR ROUGH USAGE

The ukulele, along with the mandolin, guitar, and banjo, is now made with an all-metal body. These instruments, introduced by an eastern manufacturer, are designed for the rough handling of outdoor use which soon damages the ordinary instrument, and for children wishing to learn to play. A special mandolin, 21 in. long and 9 in. wide, has been designed as a toy. The hollow-steel body provides a lightweight durable instrument that can be played with the same satisfaction as any similar string instrument.



These String Instruments, Built in Russian Style, Are of Steel so as to Withstand the Hard Knocks of Serenading

SURPLUS WATER SUPPLY UTILIZED FOR POWER

Having a water supply far exceeding the requirements of its present population, the authorities of the small town of Port Alberni, B. C., decided to utilize this surplus for generating electricity for lighting purposes. The source of the water supply is a creek seven miles distant, with a head of 610 ft., and allowing for friction and all losses in transmission, there was an effective head at the power house of 333 ft., which at ordinary rates of efficiency made available a power of 120 hp., being all that was required to generate enough current for lighting the town for some time to come.

MEASURING DEVICE SAID TO REVEAL MORAL CHARACTER

That it is possible to determine moral character by physical measurements, is the claim of Professor Burger, of Berlin. He has designed an instrument for that purpose which he calls a "plastometer." It is a metal device which fits over the head of the subject. The inventor claims that with its assistance he can determine facts relating to the character of any person in one hour, which it would otherwise require many months of close observation to learn. He believes that the apparatus will greatly aid authorities in the study of criminals.

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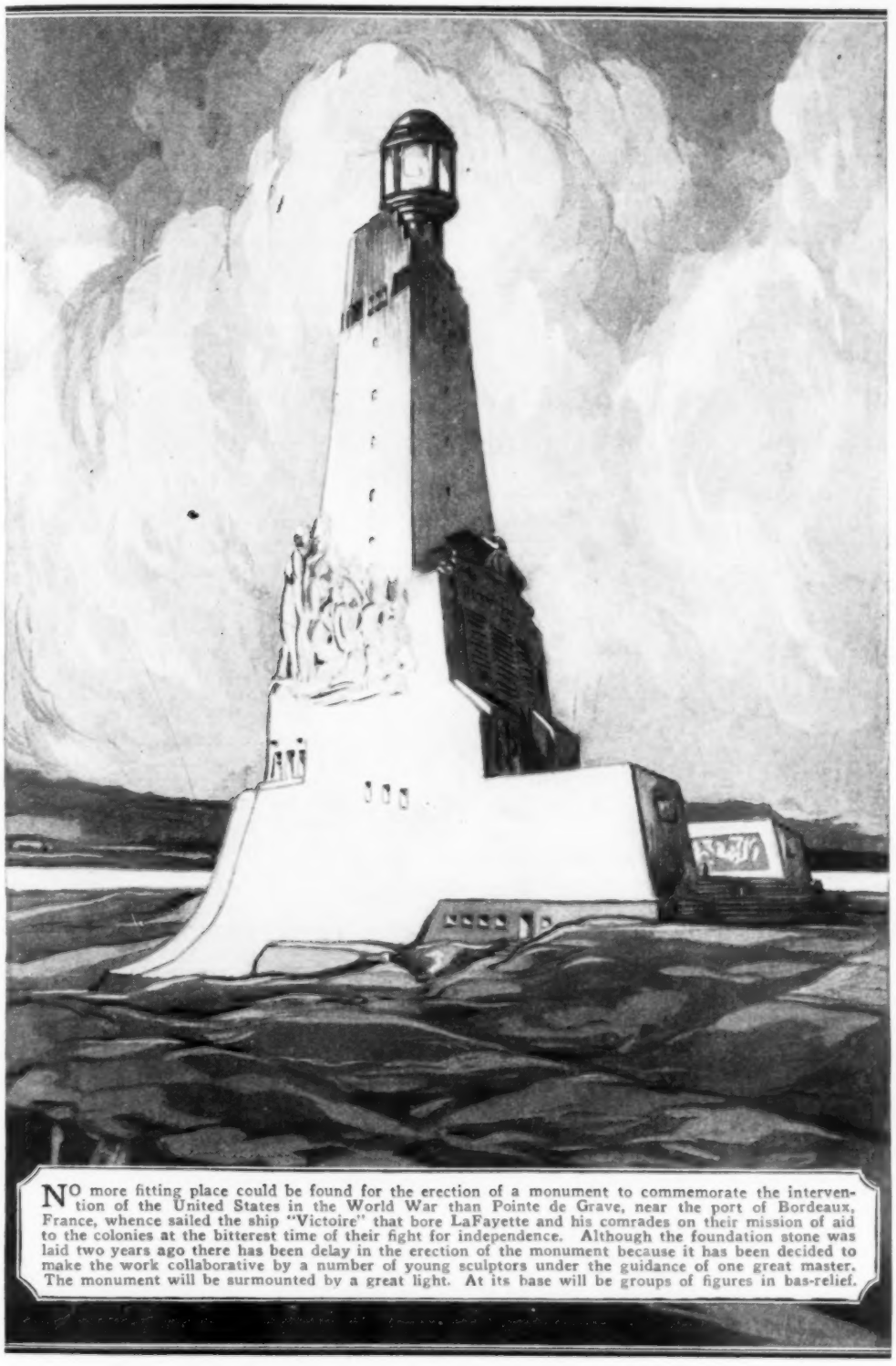
¶A resolution providing for the coining of a 100-per-cent nickel five-cent piece has been introduced in the Canadian House of Commons. The United States nickel is 75 per cent copper.

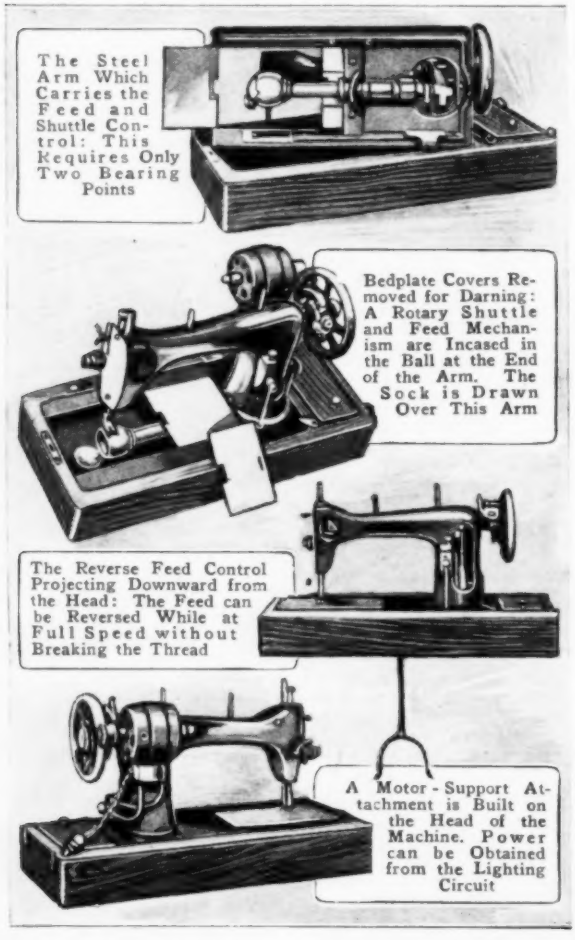
MEMORIAL OF AMERICAN INTERVENTION IN THE WAR



NO more fitting place could be found for the erection of a monument to commemorate the intervention of the United States in the World War than Pointe de Grave, near the port of Bordeaux, France, whence sailed the ship "Victoire" that bore LaFayette and his comrades on their mission of aid to the colonies at the bitterest time of their fight for independence. Although the foundation stone was laid two years ago there has been delay in the erection of the monument because it has been decided to make the work collaborative by a number of young sculptors under the guidance of one great master. The monument will be surmounted by a great light. At its base will be groups of figures in bas-relief.

SIMPLIFIED SEWING MACHINE DOES FAMILY DARNING

Since the first complete development of the lock-stitch machine in 1844 by Elias Howe, the sewing machine has been made to reproduce almost every operation of hand sewing. A machine that will do the family darning has now been patented. Its essential feature is a steel arm which carries the intricate mechanism controlling the shuttle and feed. This is incased in a ball at the end of the arm. In this way about 20 parts have been eliminated, making maintenance less expensive, and because of its simplicity, requiring less power to run. In darning, the bedplate covers over the ball and arm are removed, and the sock is drawn over the ball and along the arm. This construction also permits the sewing and mending of various other articles that require circular seaming. An added feature is that the operator can reverse the action from forward to backward, or vice versa, simply by a movement of the knee, without breaking the thread or reducing the speed.


The Steel Arm Which Carries the Feed and Shuttle Control: This Requires Only Two Bearing Points
Bedplate Covers Removed for Darning: A Rotary Shuttle and Feed Mechanism are Incased in the Ball at the End of the Arm. The Sock is Drawn Over This Arm
The Reverse Feed Control Projecting Downward from the Head: The Feed can be Reversed While at Full Speed without Breaking the Thread
A Motor-Support Attachment is Built on the Head of the Machine. Power can be Obtained from the Lighting Circuit

CHEMICAL EXTINGUISHERS UNSAFE IN MINE FIRES

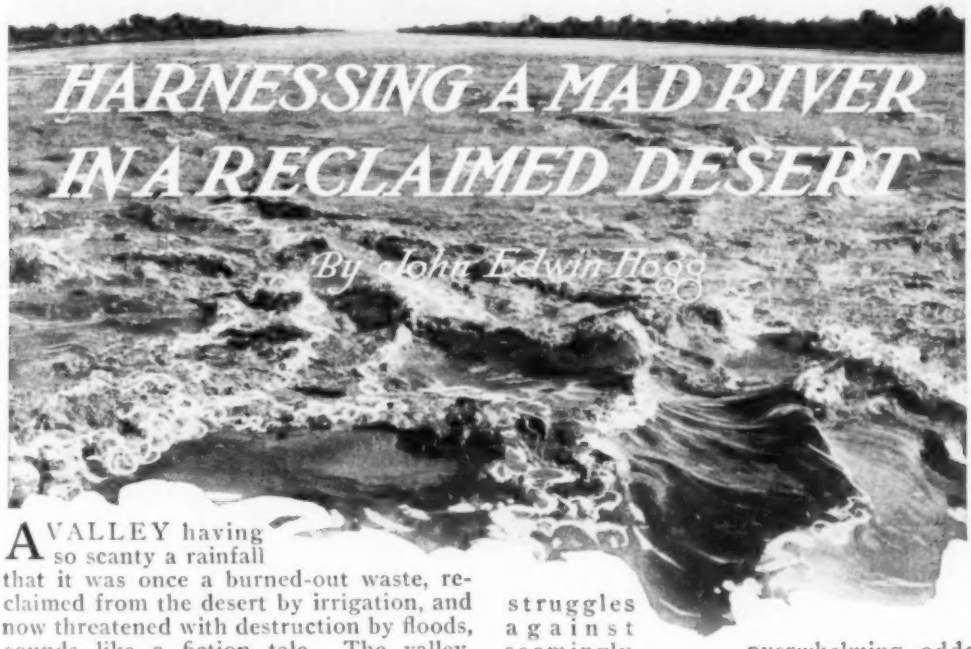
Carbon tetrachloride, as used with other elements in a fire-extinguishing combination, produces small amounts of hydrochloric acid and phosgene gases when played on a blazing fire, according to results shown by recent tests made by the Bureau of Mines. These tests were made in the bureau's experiment mine near Bruceton, Pa. After sealing the mine-entry shaft for a distance of 125 ft., a fire of excelsior and dry-pine kindlings was started and the chemical played upon it from standard extinguishers by six men equipped with goggles and breathing apparatus. Vacuum bottles were placed at various distances from the fire and samples of gas resulting from the applied chemicals, taken in them. Upon analysis, the gases proved to have a percentage of the dangerous fumes mentioned. Dense clouds of irritating yellow smoke harried some of the experimenters, who had purposely removed their goggles and covered the flames. The tests clearly indicated that caution should be observed by persons using the chemical when putting out a fire in a confined space.

IMPORTATION OF FEATHERS BARRED BY GREAT BRITAIN

A bill designed to prevent the destruction of birds, such as the osprey and bird of paradise, for their feathers, has been finally passed in Great Britain. The importation of feathers, or the dead bodies of birds with the feathers on them, into the British islands is prohibited by this bill. An exception is made of the feathers of the African ostrich and the eider duck. Feathers worn by travelers, or carried in their baggage, will also be admitted if it can be shown that they are for personal use only. The passage of the bill is the result of a long campaign against cruelty to animals.

HARNESSING A MAD RIVER IN A RECLAIMED DESERT

By John Edwin Hogg



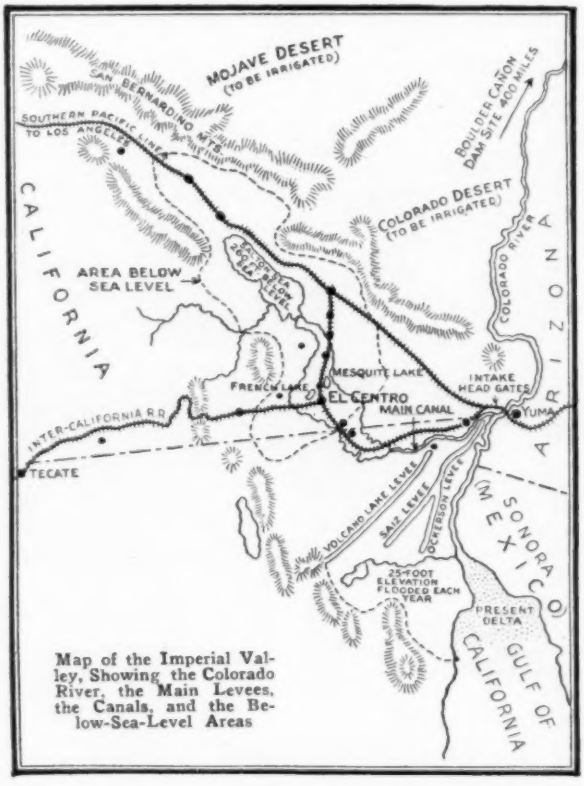
A VALLEY having so scanty a rainfall that it was once a burned-out waste, reclaimed from the desert by irrigation, and now threatened with destruction by floods, sounds like a fiction tale. The valley, however, which has been saved from the flood menace for another year, and which will eventually be thoroughly safeguarded by modern engineering skill, is not one such as the imagination of genius might have created, but is the famous Imperial Valley of California and Mexico.

Probably no other farming district has ever waged such a series of spectacular struggles against seemingly overwhelming odds as the battle against floods which was only recently fought to a successful conclusion along the banks of the Colorado River in the Mexican state of Lower California. The battle just won, however, does not mark the signing of an armistice in the warfare between the Imperial Valley and the Colorado River, the river which made the valley and now threatens

Flooded Mexican Farm Lands and Homes in Front of the Volcano Lake Levee during the High Water of 1921; If the Levee Failed, the Flood would be Discharged into the Canal Shown in the Foreground

to ruin it. The fight has been won for this year only. It will be renewed next summer, probably with a few new quirks of engineering skill—and with the final treaty of peace between the valley and the river at least five years in the future. The ultimate defeat of the river is inevitable.

To understand the Imperial Valley and the fight which is being waged to save it, we must consider its origin and its relation to the geographical surroundings. The valley was once at the bottom of the Gulf of California. In some dark prehistoric age ocean-going ships could have sailed up the gulf where prosperous cities and productive farm lands are now situated. They could have sailed northward almost to the foot of the San Bernardino Mountains of Southern California to within nearly 100 miles of the present site of Los Angeles. For unnumbered centuries the Colorado River poured its floods into the gulf, carrying approximately one per cent of alluvial silt with its waters. The silt settled as the river reached tidewater, so that in the progress of ages the entire north end of the gulf was filled with a rich alluvial soil. The river cut a new channel to tidewater farther south. In time the old delta dried up, leaving a plain which slopes northward from an elevation of about 40



Map of the Imperial Valley, Showing the Colorado River, the Main Levees, the Canals, and the Below-Sea-Level Areas

A View from the Volcano Lake Levee, Showing One of the Old Levees, Broken Through and Abandoned After the River Bed had Built Itself Up from the Deposits of Silt to Render the Old Levee Useless

One of the Many Enormous Concrete Head Gates Used to Control the Flow of Water through the Imperial Valley Irrigation Canals: Should the Protecting Levees Ever Break the Greatest Damage would Result to the Present Irrigation-Canal System. All of These Structures are Built upon the Bottomless Delta Silt, and would be Torn Out by a Flood

ft. at the south to 260 ft. below sea level at the lowest point to the north. This delta only awaited the digging of canals to bring the waters of the Colorado upon it and convert it into a vast garden from which scores of long trains leave every day carrying its products to the markets of the world. Prosperous cities sprang up in the valley, which in 20 years has been converted from a desert waste into a farming region whose total wealth runs into billions, and which produced a $50,000,000 crop last year.

The valley had not been reclaimed from the desert many years before men began to realize that the Colorado River had not altogether completed the work which has made this garden spot possible. The river, fed by the melting snows of Colorado, Utah, and Wyoming, is subject to extraordinary periods of high water. There is evidence, too, that the river periodically overflowed into the great below-sea-level valley long after the original delta land had been formed. In order to protect the valley from floods, great levees were built across the south end of the valley from the high ground on the east to the low range of volcanic mountains which bound it on the southwest. These levees lie entirely in Mexico. It should also be mentioned here that the canals, through which the Colorado River is taken bodily into the Imperial Valley, start in California, cross into Mexico, about two miles below the intake, and after winding through 60 miles of Mexican territory come back into the United States. The canals were built through Mexico because that route offered the simplest engineering problem. At that time the land south of the international boundary was considered worthless. However, American engineers, with American capital, undertook the work. An agreement was made with Mexico to the effect that for the privilege of running the canals through its territory, as much water as required would be furnished free to Mexican landowners.

After the Heat had Melted the Wax Insulation Out of the Levee Construction Work Field Telephones, the Telephones were Provided with Shades

The Colorado River has never ceased to bring down the same quantities of silt it brought to make the valley. As it nears its outlet during flood season in the Gulf of California the silt is deposited in the river bed. Ever since the valley was brought under cultivation the river bed has been building up at the rate of about one foot per year, so that each year it has been necessary to increase the height of the levees. Higher and higher the levees have gone, and obviously there is a physical limit to the height to which they can be built to withstand the river. The work of raising and strengthening them is rendered complicated by the silty character of the valley soil. The silt, when dry, is as fine-grained as talcum powder, and when it comes in contact with water it "melts" away. This is the sort of material the levees are built of.

Why not build the levees of rock, or some other more substantial material? That is the logical question in the mind of every thinking person when he learns what the levees are made of. The answer of the engineers to this question is simply: It can't be done. There is nothing but silt to build them on. In an effort to locate bedrock, or something solid to fasten the levees to, borings were recently made to determine the character of the subsoil. The delta was sounded to a depth of 1,400 ft., but nothing was brought up but the same sort of silt that is found at the surface. Reinforcing the levees with rock has also been tried, but with only partial success. If the side of the levee is ballasted with rock the water washes the silt from under it, and the rocks slide off into the flood. The same rock, if let alone, will keep on going down until it is swallowed up by the delta. Riprapping with brush has been tried, but with little more success. The water simply cuts under the riprapping, and away goes the brush into the Gulf of California.

All of the work on the levees must be done in temperatures up to 130° F. In such blistering heat men find difficulty in working under the pressure of necessity. To expedite the work along the three levees, which form a sort of first, second, and third-line defense, a field-telephone system was installed. In less than 48 hours after the telephones were put in, every one of them went out of business. An inspection revealed that the wax insulation of the telephone instruments had been melted by the heat. Another telephone net was built. In this, the instruments were put under shades, and it has operated satisfactorily ever since.

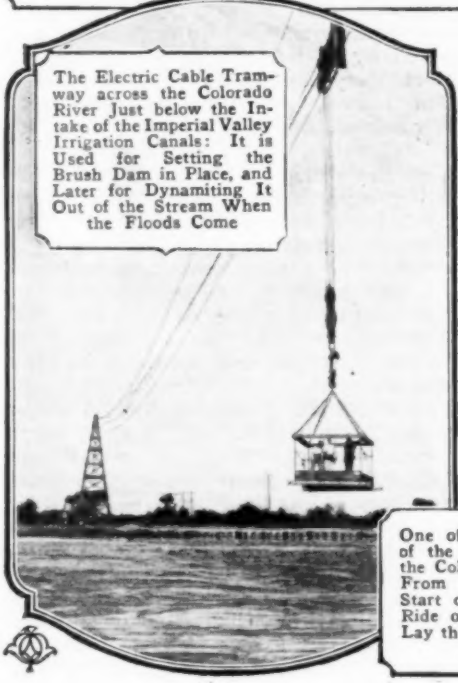
This Train was Sent down the Levee to Close an Impending Break, but Before It Reached Its Destination the Track Settled under It, and the Train Rolled Over into the Flood Waters

Machinery has been employed to do as much of the work as possible. Railroads have been laid along the tops of the levees for hauling men, machinery, and materials. This summer when the fight on the Volcano Lake levee, the last line of defense, was at its height and it seemed that unless the flood subsided the levee would not hold out 24 hours, a work train pushing a grading machine, and pulling several other cars of equipment, was sent down the levee. This was so badly water-soaked, however, that before the train reached the scene of action the track settled beneath it, and the whole outfit toppled over on its side into the flood waters. With heroic speed, and dauntless effort, the laborers built a "shoofly" around the wreck, and another train was sent to close an impending

A Section of the 1921 Brush Dam, Which is Put across the Colorado River Immediately after the Flood Season to Impound What Water is Left for the Irrigation of the Imperial Valley: A Row of Piling is Driven across the River. The Brush Segments are Then Placed against the Piling with the Small End Upstream. They are Weighted to the Bottom of the Stream with Sandbags, and a Suction Dredge Completes the Work of Making the Dam Water-Tight. The Dam is Dynamited in the Spring

Rockwood Head Gate, Which Controls the Flow of the Colorado into the Main Imperial Valley Irrigation Canal: It is Built of Concrete, on Bedrock, and Is Capable of Withstanding Any Flood. The Barges in Front of the Gates Are for the Purpose of Fending Off the Floating Brush Which Comes down the River

The Electric Cable Tramway across the Colorado River Just below the Intake of the Imperial Valley Irrigation Canals: It is Used for Setting the Brush Dam in Place, and Later for Dynamiting It Out of the Stream When the Floods Come



One of the Anchorage Bases of the Cable Tramway across the Colorado at the Dam Site: From These the Workmen Start on Their Dizzy Trolley Ride over the River, First to Lay the Dam and Later to Destroy It

break, just as the flood began to subside, and the battle for this year was won.

Much of the flood fight has been carried on behind the levees by digging a series of canals and reservoirs which will be capable of impounding the greater portion of any flood water which may break through. Two of these reservoirs are French and Mesquite lakes, in the vicinity of El Centro. These reservoirs can take care of several thousand acre-feet of water each, and should they ever be called upon to impound flood waters in excess of their capacity, a series of natural and artificial canals will take the surplus into the Salton Sea, the natural catch basin for the flood if the levees should fail. This sea is the lowest point in the valley, 260 ft. below sea level, and any water which might break over into the valley would naturally seek this spot. The Salton Sea, and its surrounding basin, is capable of holding all of the water that might run into the valley during two seasons' floods, without raising the level of the sea more than 30 or 40 ft. Such an occurrence would, of course, inundate a vast acreage of valuable agricultural land in the lower end of the valley, and would swamp several cities in that vicinity. However, the greatest menace of the impending floods would not lie in the total inundation of the entire valley, but in the wrecking of the irrigation-canal system.

The flood menace became a real one for the first time in 1905, but not through the failure of the levees. At that time the agricultural development had progressed so that the then existing head gates were unable to supply sufficient water for irrigation. Crops were burning up for lack of water, and the farmers implored the engineers to do something to supply more water. In desperation, and against their better judgment, the engineers dug an opening around the main head gates from the river to the canals to let down more water. The farmers got the water all right, but about a 10 years' supply all in one dose! When the river bank was cut through around the head gates the river began to rise. It became a roaring torrent, which swept down the canals out of all control. The 50-ft. opening in the river bank, cut to let more water down, was washed out a mile wide, and for months the entire river raged down into the valley on its way to the Salton Sea. The torrent which swept through the valley took everything before it, and two miniature Grand Cañons were cut through the alluvial silt from the river to the Salton Sea. It was the flimsy character of the soil that made the cutting of these channels possible, confining the mad rush of the water to those two paths, and preventing the entire cultivated area of the valley from being swept into the Salton Sea. The cutting of these two channels, now known as the New and Alamo rivers, was a blessing in disguise for the future development of the valley. They are looked upon as a piece of nature's engineering work as a protection against future floods.

Recently completed head gates of solid concrete, anchored on bedrock at a point farther up the river, are able to handle the entire volume of the river at normal times, and to withstand any flood; so the problem today has sifted down to fighting the water back from the levees during the flood season, and then getting sufficient water through the head gates during the period of low water. Obviously, the control of the Colorado has been a severe financial drain upon the resources of the valley, and the existing agreement with Mexico has complicated the international situation by throwing the entire burden of expense upon the valley population north of the Mexican boundary. The people south of the boundary, while enjoying the benefits of free water, and long profits from bountiful crops produced at little expense, have not contributed a single peso to the canal development and flood-protection work. Meanwhile their government has also profited by it, by levying the customary import duty upon every spade, every steam shovel, every locomotive, every bite of food, and everything else which has been taken across the boundary for use in the work. Of course, under the existing agreement, it cannot be called upon to bear any part of the expense. But conditions have changed materially since that agreement was made, and negotiations are now pending with Mexico which look to such alteration of the original treaty as would be satisfactory to both the American and Mexican sections of the valley.

The Colorado River runs wild every spring. Then, late in the summer, there is scarcely enough water to irrigate the Imperial Valley. At that season not one drop of the river flows into the Gulf of California, its entire volume being diverted down the irrigation canals. During the high water this year, the battle to hold the levees was won by a "gnat's eyebrow," as the river for nearly six weeks discharged into the gulf at the rate of 185,000 cu. ft. per second. This is

A Spur of the Volcano Lake Levee Which Went Down before the Onslaught of the 1921 Battle against the Colorado River. When a Break in a Levee Occurs the Rush of the Waters Quickly Plays Havoc with the Silty Soil, of Which the Levees are Chiefly Constructed

enough water to irrigate half the entire Southwest for a year, yet the battle with the river to save the Imperial Valley from flooding is scarcely won before a crew of men begins driving piling upon which a peculiar dam of brush is anchored to impound the surplus water for use during the remainder of the year. Next spring, when the river goes mad again, a few hundred pounds of dynamite will scatter this brush dam to the four winds, to give the river clearance to the Gulf of California.

With the river bed silting up from flood waters at the rate of one foot a year, the engineers in charge of the irrigation and flood-control work frankly admit that five more years is about as long as they can expect to hold the levees. A longer fight would necessitate sky hooks, or some other undreamed-of method of holding them. Furthermore, if the American end of the valley were compelled to continue to finance the fight alone, bankruptcy would stare its population in the face. The valley would have no future but reversion to the desert out of which man created it. What, then, is going to become of it? The answer is, simply—the valley is going to be saved by engineering skill. Its people and its cities will remain prosperous and thriving. It will continue to produce 11 crops of alfalfa per year, and its long refrigerator trains will go on carrying truck produce, cotton, and foodstuffs to the markets of the world. And out of the saving of the Imperial Valley, we will see a score or more new "imperial valleys," for the salvation of the valley lies farther up the river. Up above the Grand Cañon of Arizona; in Diamond Cañon, below the Grand Cañon, and in Boulder Cañon, above Needles, Calif., surveys have been made, and construction work has actually begun upon a series of the most colossal reservoirs, irrigation and hydroelectric projects, that the world has ever seen. The "Mad River of the Desert" is to be corralled nearer the source of its floods. Long before the Imperial Valley levees become hopeless, the river will be hobbled and broken to make it a steady and harmless stream, docile and subservient to the will of man. The check dams and reservoirs will be built where there is bedrock to anchor them, and hydroelectric power sufficient to turn all the wheels of commerce west of the Rocky Mountains will be developed. This power will be used to convey the impounded waters to 2,000,000,000 acres of now parched desert lands, which only await the construction of irrigation ditches to convert them into gardens. Cities will spring up on sites now barren and waterless, and there will be homes and prosperous farms for unnumbered thousands.

When this work shall have been completed, the annual fight along the Imperial Valley levees will be history. There will be irrigation water in abundance, but it will be sent down the river bed in only the quantities needed. Then, if the international problem still exists, the money which has annually been spent upon the levees will be available for the digging of an all-American canal.

GELIGNITE SHATTERS LOFTY ENGLISH SMOKESTACK

Citizens in the vicinity of Hounslow, a suburb of London, England, were treated to a thriller in the form of a falling smokestack, recently. The stack, part of an abandoned powder mill in the town, was no longer useful and was therefore to be razed. Gelignite, an explosive very similar to dynamite, but having a nitrate of potassium basis instead of infusorial earth, was used to the extent of 1½ lb. The 120-ft. brick column careened and crashed to the earth immediately after the explosion.

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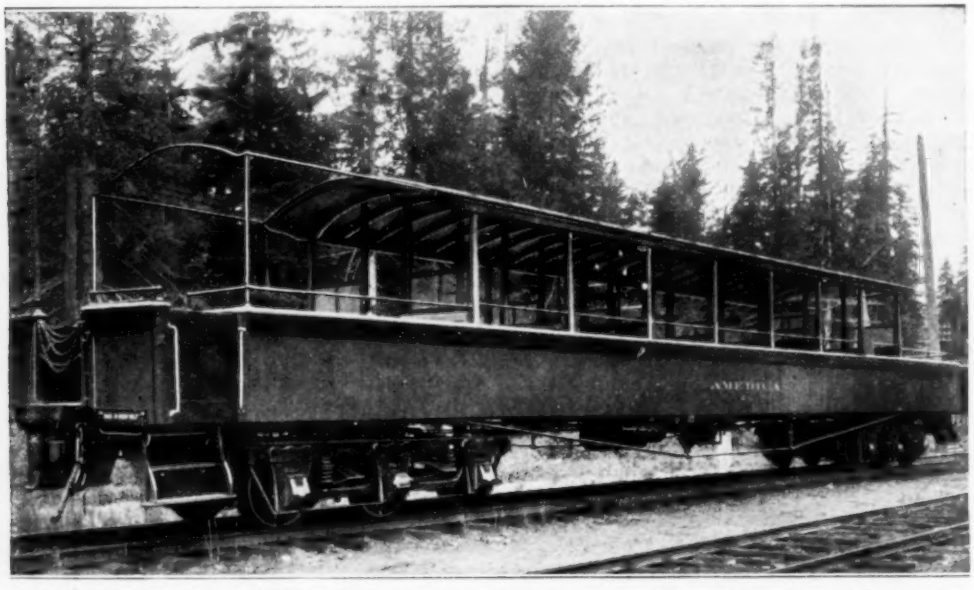
Gelignite, a Powerful Explosive, was Used to Topple This 120-Foot Brick Smokestack, near Hounslow, England

NEW OPEN-AIR OBSERVATION CAR ON ST. PAUL RAILROAD

Electrification having done away with the cinder, gas, and smoke horror that goes with steam-propelled railway trains, it is possible for the Chicago, Milwaukee, and St. Paul Railroad to adopt an ideal open-air observation car on part of its route. The car is built similar to a sleeping car, with the exception that there is no upper berth, the lower seat only being constructed sectionally and allowed the usual Pullman space. A roof covers the central part of the car and is built to leave an uncovered platform at each end. Between the seat compartments glass windshields are installed to prevent the sweep of uncomfortable drafts when the car is moving swiftly. From this car the passengers get an unrestricted view of the beautiful mountain country through which it travels and also have the additional advantage of pure, fresh air.



This Open-Air Observation Car is Used on the Electrified Section of the Chicago, Milwaukee, and St. Paul Railroad. In Addition to the Covered Part, the Car Has Two Roofless Platforms

Three Views of the Phonograph-Camera Combination: Left, Door of Camera Down and Phonograph Tone Arm Laid Back; Middle, Phantom View of Inside Arrangement of Parts; Right, Unit Set Up for Operation

PHONOGRAPH AND CAMERA IS NEW COMBINATION

The latest novelty in pleasure equipment is a phonograph-camera combination. A regular spring-wound motor drives the phonograph part and is located within the camera box. Nearly all the modern adjustments with relation to tone variation and speed are included in the construction of the phonograph. When folded for use as a camera the winding crank for the motor and tone arm are placed within a compartment provided for them in the box. The contrivance is so compactly arranged that it makes a handy accessory for outings.

BATTLESHIP "NEW MEXICO" WINS EFFICIENCY PRIZE

Every year the government awards a pennant and other trophies for the highest mark of efficiency in gunnery and engineering shown by the ships of various classes in the navy. The battleship "New Mexico" has received the awards for the competition just closed. This is the second award to be received by the dreadnaught, the first being for supremacy last year. The ship will not only obtain the prize but will also be allowed to paint a white "E," which indicates excellence, on its smokestack. The "New Mexico" has been the flagship of the commander-in-chief of the Pacific fleet since its organization in 1919.

FISH TAILS FOR HAT TRIM IS LATEST MILLINERY FAD

In trimming her hat with the tails of mackerel, one Long Beach, Calif., girl has set two precedents. One of them was a use for mackerel tails, and the other, a new and charming style of millinery adornment. The tails of the fish were chemically cleaned and deodorized, after which they were treated with aniline dyes. The effect when the light strikes them is beautiful, as they shine with great brilliancy. The supply of tails is unlimited.

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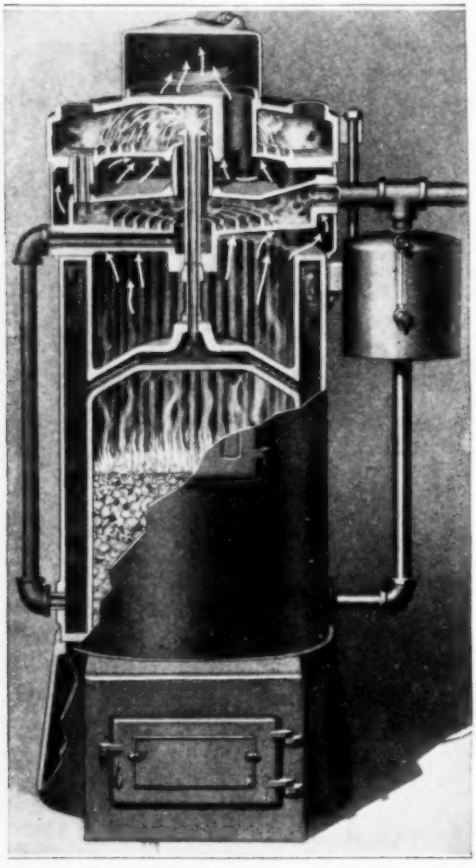
¶The summit of Mont Blanc, 15,872 ft. high, was the scene recently of a remarkable feat in aviation. A French airman landed there with his plane, got out of the machine, walked around for about 10 minutes, and then flew away, and 20 minutes later landed safely at Chamonix, the well-known Alpine resort at the base of the mountain.

STEAM-HEATING BOILER BUILT ON PERCOLATOR PRINCIPLE

Emulating the study of the teakettle by James Watt, which resulted in the invention of the steam engine, two New-



Water Fed to the Flat Receptacle above the Fire Pot Percolates to Upper Hot Plates and is Converted to Steam

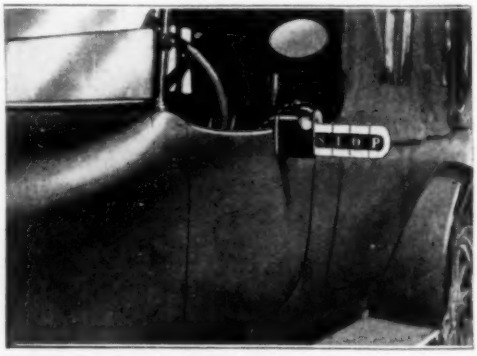
ark, N. J., men accomplished what is claimed to be remarkable progress in the construction of steam boilers through a study of the coffee percolator. The water, instead of being heated in large quantities, is boiled, a gallon at a time, in a flat receptacle just over the fire pot. As in the percolator, the heated water rises in a tube to the top of the boiler, where it drops in a spray over a series of corrugated plates heated by the fire below and by the hot gases which pass up the flue. The water being only ¼ in. deep, quickly becomes steam. The excess of water drips down on a lower set of similar plates. The saving in fuel is said to be considerable.

MACHINE-SHOP RULE SOLVES MANY LATHE-WORK PROBLEMS

A very comprehensive machine-shop rule, now on the market in New York, makes possible the solution of many problems in connection with lathe work, without the lengthy calculations that would be otherwise necessary. From graduations on one face of the rule, which is about 1¼ in. wide, there can be read: the number of revolutions in proportion to the diameter of the bar and the cutting and grinding speed; the time required to turn or grind a bar in proportion to its length and rate of feed and revolution; the volume of metal removed in proportion to the depth of a cut, the rate of the feed and its speed; and the area machined in proportion to the rate of the feed and the cutting speed. On the other face of the rule are very complete inch and metric graduations, so that it can be used as an ordinary measuring rule.

TELESCOPING AUTO SIGNAL HAS NEW FEATURES

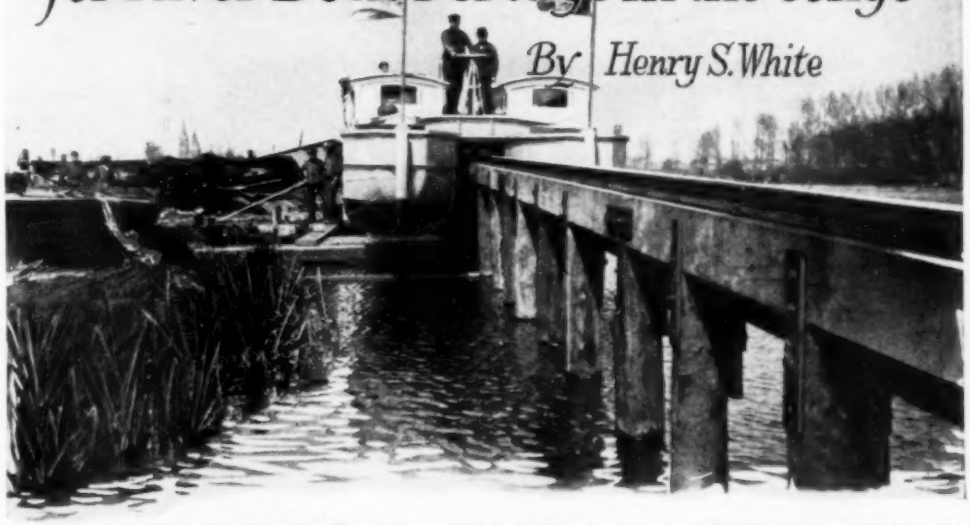
There is an abundance of auto signals on the market, but a new device of the sort has some original features. It consists of a small 1 by 4-in. black metal case, which holds a semaphore board. This board is made in telescoping sections and may be operated either mechanically, by a hand or foot lever, or electrically. A clamp, by which it is attached, fastens to the left door of the automobile and holds the device in a rigid position. In turning a corner the mechanism is operated which causes the semaphore to extend from its case, giving warning to the car behind. A light with a red and a white lens at opposite ends, as well as a mirror, are additional features.



This Auto Signal is Made in Telescoping Sections. It is Operated Mechanically or by Hand

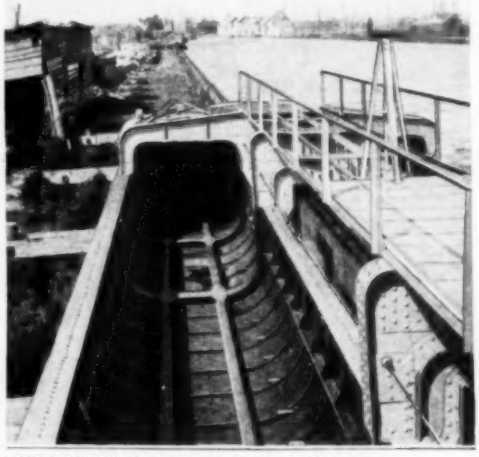
Belgium Builds Strange Railway for River Boat Portage in the Congo

By Henry S. White



The Twin Boat That Straddles the Monorail on Which It Runs is Seen Bow-On Traversing a Shallow Part of a River. Having No Grade to Climb, It Travels on a Standard T-Head Rail

THE most inaccessible of the earth's wildernesses are easily accessible as far as their rivers are navigable. If the rivers were continuously navigable, the remotest depths of these wildernesses would be readily reached. But in all such territories the rivers are of a very unaccommodating nature, being interrupted at intervals by waterfalls, rapids, shallows, and other obstacles that make continuous navigation impossible. Hitherto traveling on such rivers has always had to be done on the installment plan, so to speak. There would be a number of miles of navigable stream, then a portage, which, in the case of anything larger than a canoe or a scow, would mean a complete transfer overland of freight and freighters from one vessel to another, succeeded by some miles of navigation to the next portage, with another transfer, and so on repeatedly, depending on the length of the river, and of the journey.



PHOTOS BY COURTESY OF THE INVENTOR, ROBERT C. GOLDSCHMIDT

Interior of the Hull Amidships of One of the Twin Boats: The Platform to the Right Is over the Monorail and the Brackets That Link the Two Units

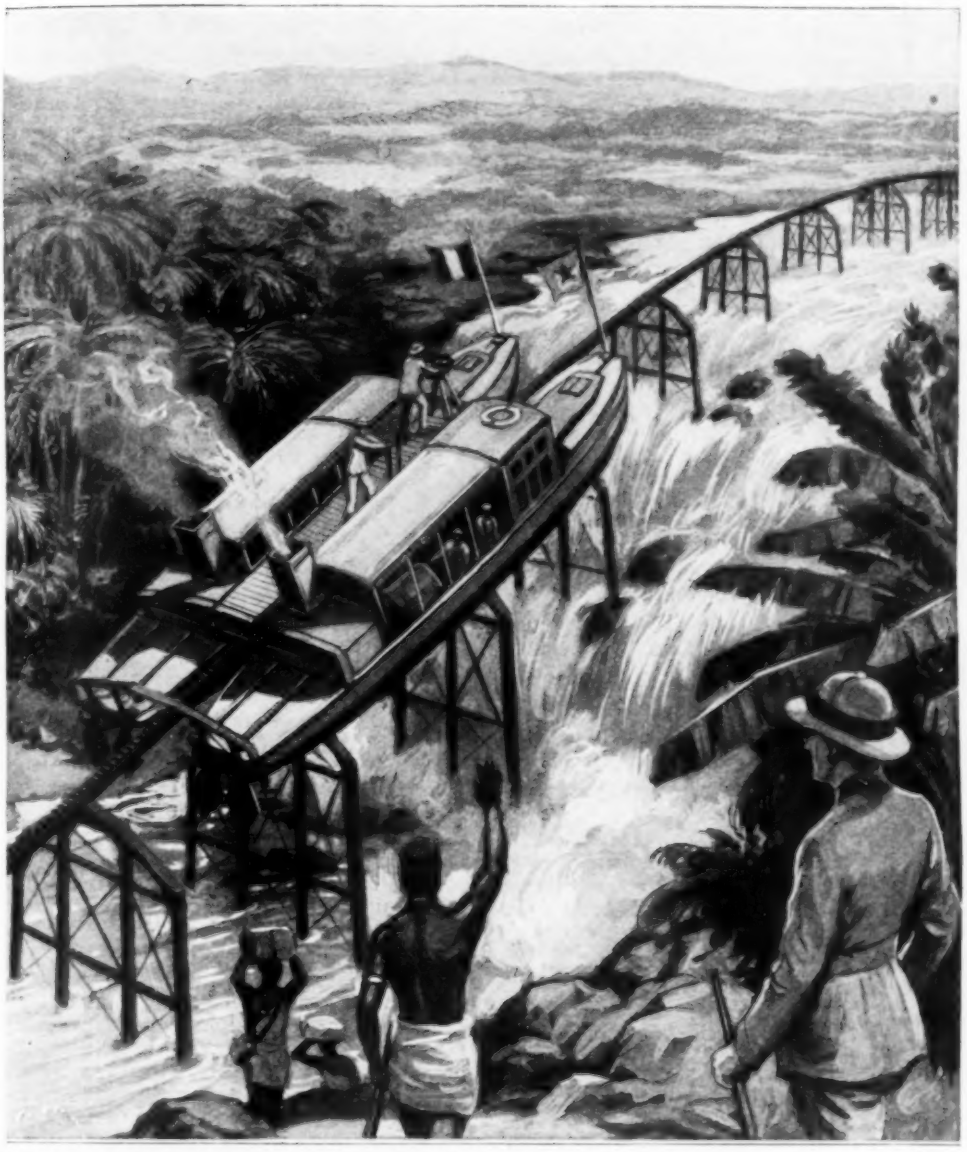
It is obvious, therefore, that any means of making the journey along such rivers uninterruptedly in the same vessel would make transportation very much more rapid and economical. Such a means has been developed experimentally in Belgium for use in the Belgian Congo, that African colony that is 83 times the size of Belgium itself. The products of this vast undeveloped territory all have to be transported from the interior to the coast for export, and it is now proposed to adopt methods on the great river Congo

that will make possible uninterrupted transportation. The work has been done under the direction of the Belgian government, and several schemes were tried out on the canals near Antwerp. The main feature of the favored scheme is a vessel that will travel by either water or land. Thus, where the river is easily navigable it runs along, propelled like any other ordinary steamboat, and when it reaches any such obstacle to navigation as a waterfall, a rapid, or a shallow, it leaves the water and traverses the obstacle on a permanent single-track railroad.

The vessel is composed of twin hulls, connected with overhead plate-girder brackets that retain the hulls rigidly and permanently parallel to each other, with a space between them of about half the width of each hull. When afloat, each hull is propelled by its own power plant, each having a propeller and a rudder. In the space between the hulls, and supported by the plate-girder brackets that connect them, are toothed wheels that, by means of a train of gears, can be switched into driving connection with the power plants, which are thrown out of connection with the propellers. These toothed wheels are for running on a rail in the form of a rack, the teeth of which fit those of the wheel. This rail is the means of converting the twin boat into what might be called a twin coach balanced on either side of a monorail, so as to make it somewhat like the coach of a monorail road, of which many are in use in various places. In the same manner this monorail road is in the form of trestles, suitably spaced and constructed to support the rail at a grade and in a direction that enables the boat to leave the water at the beginning of any obstacle, and enter it again at the end of it. These tracks will be permanently installed at every obstacle to navigation, and thus the river Congo will be as easily traversed as if it were one of Belgium's many home canals.

In the elaborate series of tests that were made in Belgium, other types of amphibious vessels were tried out which also depended upon a twin-hull construction with a monorail, but there was one type that was on a different principle. In this, any ordinary boat of suitable width could be adapted to travel on the railroad, which was composed of two parallel rows of lattice columns separated widely enough to allow the boat to pass between them. At the top of each of these columns was mounted a roller, resembling a small idler pulley, which overhangs so that it engages a rail that is connected to the side of the boat along its whole length. These individual columns, on either side of the boat, are spaced so that

Stern View of a Twin Boat of Smaller Size, Riding Its Monorail beside a Bank of the Willebroeck Canal, in Belgium: On Proceeding, the Twin Boat will Leave Its Rail and Launch Itself in the Water, Where It will Travel under Propulsion of Its Screws



A Twin Boat Climbing a Waterfall on the Congo River, Saving the Necessity of a Portage and a Change of Ships: The Monorail on Which the Boat Travels in Such a Place Is in the Shape of a Rack Which Meshes with the Teeth of Geared Propelling Wheels Driven by the Boat's Power Plants

there are never less than three in engagement with the rails on the boat's sides. Thus the boat runs along a double track, continuously supported and guided. Auxiliary supports might also be provided by adding at each trestle rollers that would operate under the boat's hull on each side of its keel. Rails connected to the hull would run on these rollers, and would assist in its support. The objection to this type is that it would be difficult to make it self-propelling. In its present form it has to be hauled by a cable.

Very elaborate developments of the twin-hull type were suggested, such, for instance, as their construction in short lengths, with a self-propelling hull forward, connected, in street-car fashion, to a trailer hull astern, enabling the combination to take very sharp curves. Another proposal was to have the hulls built with their outer sides collapsible, so that

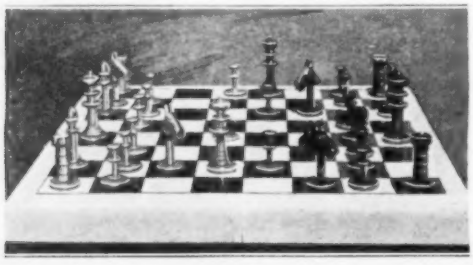
A Twin Boat Shown Bow-On, Coming into Dock Ready to Tie Up alongside the Wharf at Its Right: The End of the Monorail on Which It is Traveling is Seen Just ahead of the Boat, Which is Already Settling Down into the Water. Astern of It is Seen Another Twin Boat Still Clear of the Water

they could be folded up to facilitate their passage through narrow gorges.

The plan that was finally adopted by the investigating committee was obviously a wise selection. If it proves the success anticipated, there is no doubt that its services will not be confined to the Congo River. There are a great many places, both in the new world and the old, where the navigation of great rivers in this manner would be of incalculable value. Striking examples in the new world, are the Amazon, in South America, and in North America, the Mackenzie and the Yukon.

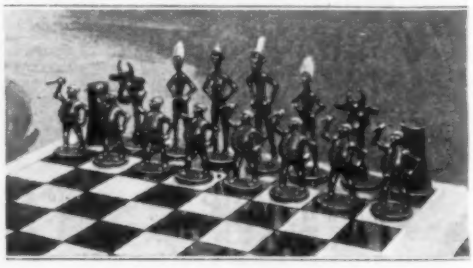
NOVEL CHESS SETS ARE MADE OF ALUMINUM

Two new inventions in chess equipment have just been announced. One is a set



A Beautiful but Inexpensive Set of Chessmen Made of Aluminum: Both the Polished Natural Finish and the Black Enamel Are Shown

of chessmen made of aluminum instead of expensive ivory. The black men are finished in automobile enamel, baked on. The aluminum set is inexpensive and indestructible. The same inventor has also created a comic set of chessmen of the same material. In place of the knight, for instance, a ferocious-looking cow's head, with eyes made of cut stones, is used.



The Figures of the Chess Set are Reproduced in Burlesque Form. This Set is Also Made in Aluminum

THE "ZR-2'S" FATAL FLIGHT

World's Largest Air Craft, Built in England for the U. S. Navy, in Final Trial Breaks and Burns over River Humber after Remaining in the Air Over 34 Hours

BY PHIL W. HANNA

WHEN the giant dirigible airship "ZR-2" broke in two and exploded over Hull, Eng., on August 24, killing almost its entire crew, it marked the failure of the largest air craft ever constructed. The "ZR-2" was a development from the British "R-34," which successfully crossed the Atlantic in July, 1919, and it in turn was patterned after the Zeppelin "L-33," brought to earth near Colchester, Eng., during an air raid in 1916.

Early in 1918, England started the construction of the "ZR-2," then known as the "R-38." It was to be the first of four ships of that type which were expected to mark a new era in lighter-than-air craft. At the close of the war, work was discontinued, but later resumed under a contract with the United States government. This country agreed to buy the great ship for 2,000,000 dollars.

The "ZR-2" differed from its prototypes in details which were calculated to reduce its weight. It is thought that this attempt to reduce weight did not allow a great enough margin of safety and was the cause of the final failure of the airship. During a trial trip on July 17, some of the middle girders showed weakness. They were reinforced and the weakness was apparently remedied. Early on the morning of August 23, it ascended for the final tests, which were reported as satisfactory. Weather conditions caused the airship to remain in the air all night, and on the following day further tests were conducted without making a landing. The accident occurred as the ship was about to return to its moorings, after remaining in the air for over 34 hours and traveling more than 1,200 miles.

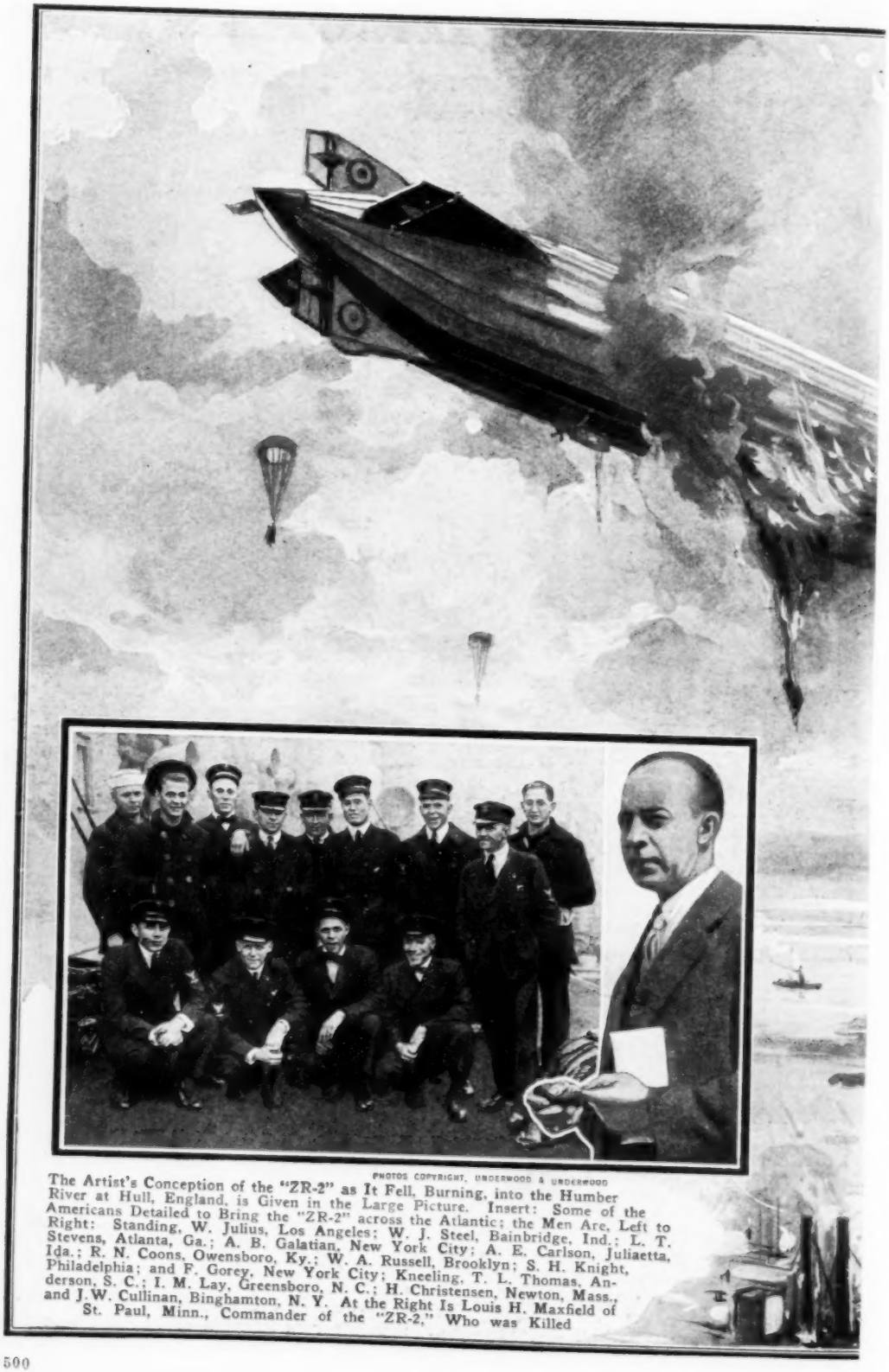
When directly over the city of Hull, a turn was made at an elevation of about 1,000 ft. Evidently one of the girders failed to withstand the strain, for the bow suddenly sagged and the balloon descended rapidly. At about 300 ft. an explosion occurred. The airship was broken into two parts and burst into flames, falling into the river Humber. A number of the 46 killed were American naval officers and mechanics who had been undergoing special training in England for several months in preparation for bringing the airship across the Atlantic.

The "ZR-2" surpassed the greatest of the Zeppelins in size, power, and speed. It was 694.5 ft. long, had a gas capacity of 2,724,000 cu. ft., and a cruising radius of 8,000 miles. It was equipped with six 350-hp. gasoline motors of the "Cossack 3" type. Each engine weighed 1,200 lb. and developed maximum horsepower at 2,000 r.p.m. Approximately 180 gal. of high-test gasoline an hour were required to operate the motors. The ship was provided with fuel tanks having a capacity of 32 tons—enough to sustain a continuous flight of more than 209 hours at a speed more than sufficient for a round trip across the Atlantic. A portion of the fuel was stored in each gondola, but most of it was in tanks located within the envelope. These tanks were so connected that pumping the fuel from one to another helped to regulate the poise of the ship. Similar tanks for drinking water and water ballast, in the envelope, were also used for maintaining balance.

The "ZR-2" was expected to develop a maximum speed of 71 miles an hour, which could be throttled down to 45 miles an hour. Its greatest diameter was 85 ft., and its height over all, 92 ft. Two days were required to inflate the envelope, at a cost of $13,600. Full inflation gave a lifting power of 82.7 tons. The ship itself represented a dead weight of 33 tons.

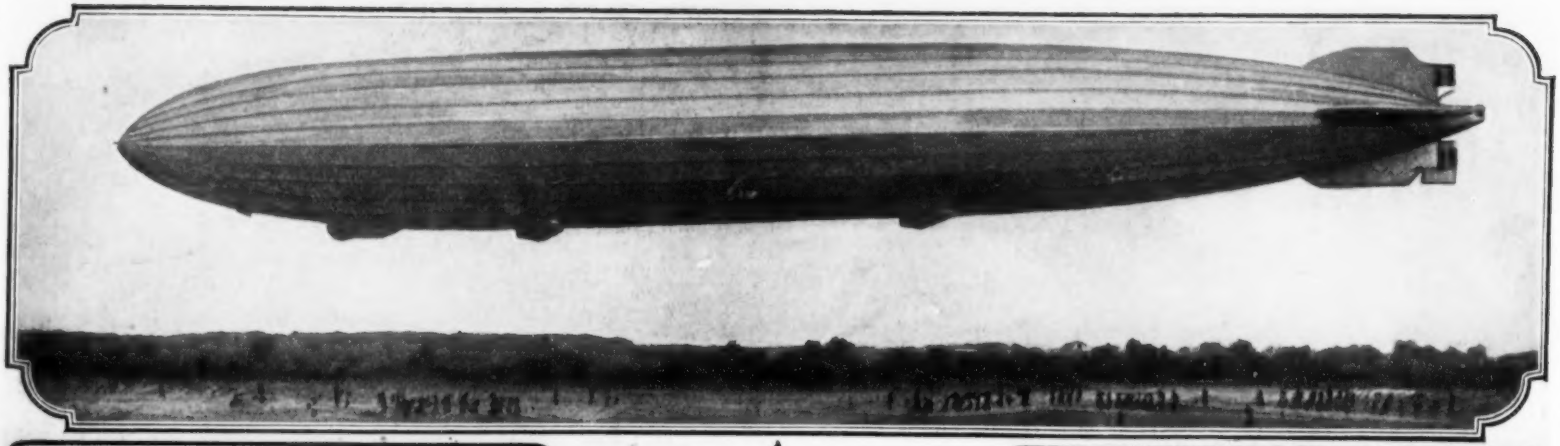
The balloon was of the rigid type. The frame was built in sections, which were carried to the hangar by a traveling crane and set up in place. It was covered with an outer skin of waterproof fabric. About seven-eighths of the interior was filled with separate inflated bags or cells of hydrogen.

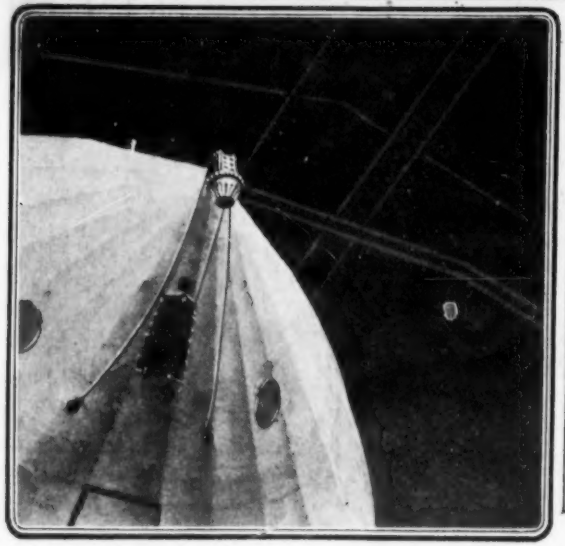
The "ZR-2" carried seven cars or gondolas. Six of these were hung in pairs, each housing a motor and supporting a propeller. The seventh car hung alone near the bow. It was devoted entirely to navigation. This main car contained a wireless telephone with a radius of 100 miles, a wireless telegraph with a radius of 1,500 miles, engine signals similar to those on the bridge of a steamship, a telephone system reaching every part of the ship, and a complete set of instruments for navigation and to indicate gas



PHOTOS COPYRIGHT, UNDERWOOD & UNDERWOOD

The Artist's Conception of the "ZR-2" as It Fell, Burning, into the Humber River at Hull, England, is Given in the Large Picture. Insert: Some of the Americans Detailed to Bring the "ZR-2" across the Atlantic; the Men Are, Left to Right: Standing, W. Julius, Los Angeles; W. J. Steel, Bainbridge, Ind.; L. T. Stevens, Atlanta, Ga.; A. B. Galatian, New York City; A. E. Carlson, Juliaetta, Ida.; R. N. Coons, Owensboro, Ky.; W. A. Russell, Brooklyn; S. H. Knight, Philadelphia; and F. Gorey, New York City; Kneeling, T. L. Thomas, Anderson, S. C.; I. M. Lay, Greensboro, N. C.; H. Christensen, Newton, Mass., and J. W. Cullinan, Binghamton, N. Y. At the Right Is Louis H. Maxfield of St. Paul, Minn., Commander of the "ZR-2," Who was Killed

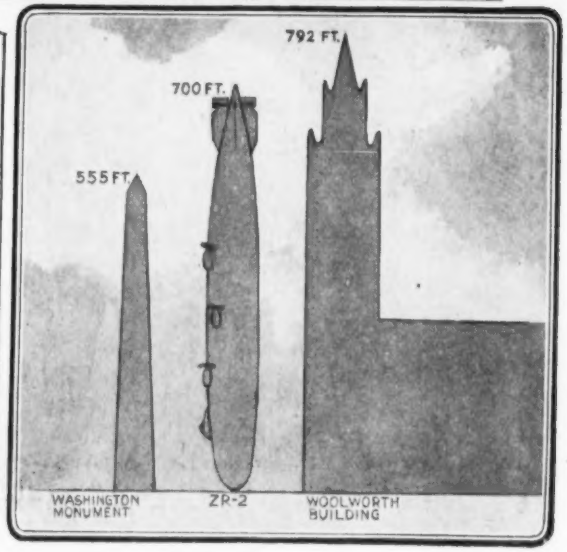


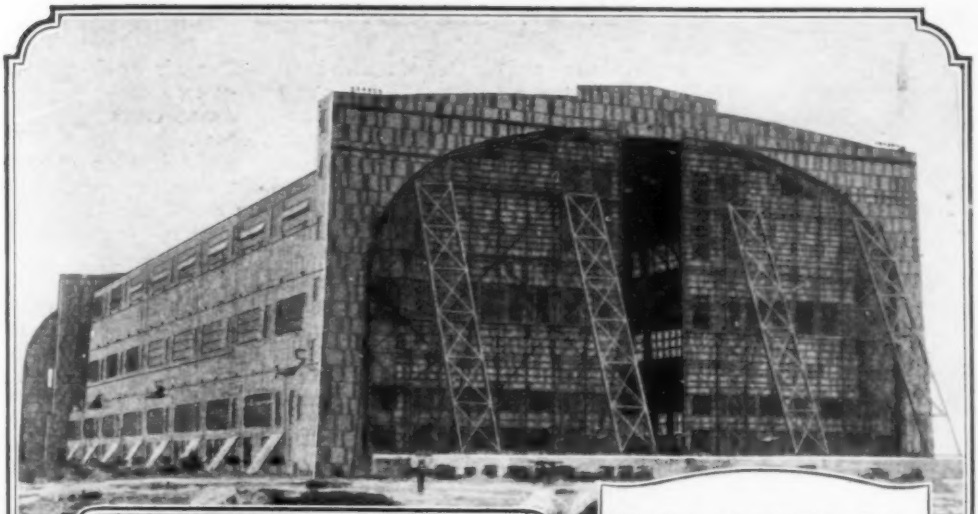


The "ZR-2" Floating over the Landing Field at Bedford, England: This Photograph was Taken at One of the Early Trial Flights. It Was during a Trial on July 17, That the Girders First Showed Signs of Weakness. This was Apparently Remedied before the Fatal Flight

At the Left: The Nose of the Envelope Showing the Apparatus for Securing the Airship to the Mooring Mast

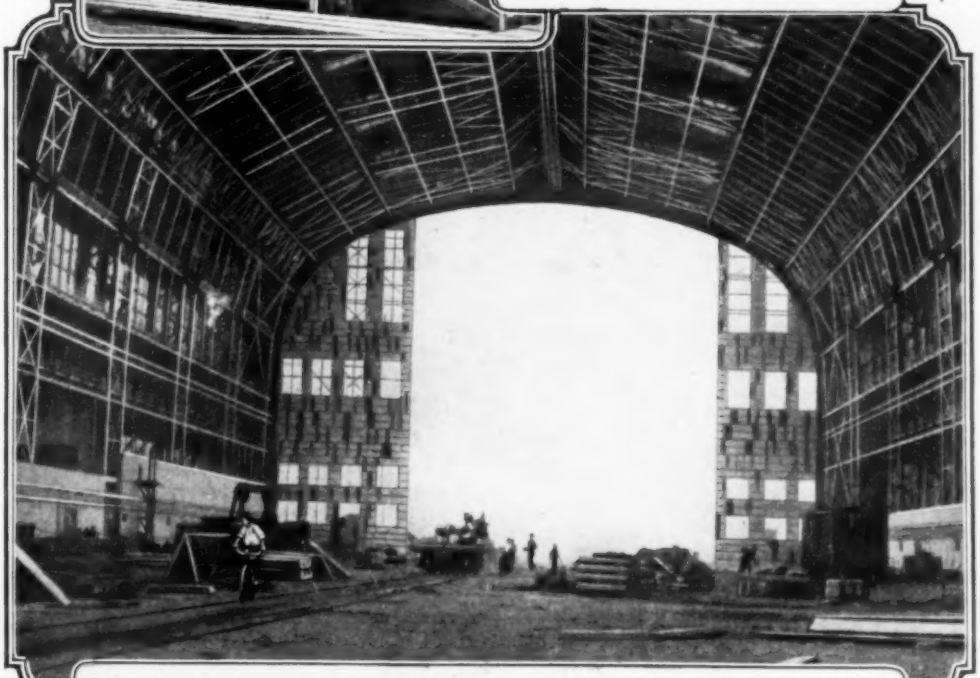
At the Right: The Airship as It would have Appeared Standing on End; Its Length Was 145 Feet Greater Than the Height of the Washington Monument and within Less Than 100 Feet of Equaling the Height of the Woolworth Tower, Yet the Entire Structure, Including the Motor, Weighed Only 33 Tons





The Hangar Constructed at Lakehurst, New Jersey, to House the Dirigible "ZR-2": It would Cover Three City Blocks and Is as High as a 16-Story Building

Twenty-Four Searchlights, Six on Each Corner of the Structure, Light the Landing Field So Effectively That Airships may Make a Safe Landing at Night



The Interior of the Great Hangar, Which Cost About $2,000,000: It Is the Largest and Most Perfectly Equipped Building of Its Kind in the World, Capable of Housing Two Airships of "ZR-2" Type, Besides Having Complete Facilities for Constructing Similar Dirigibles of as Great Size

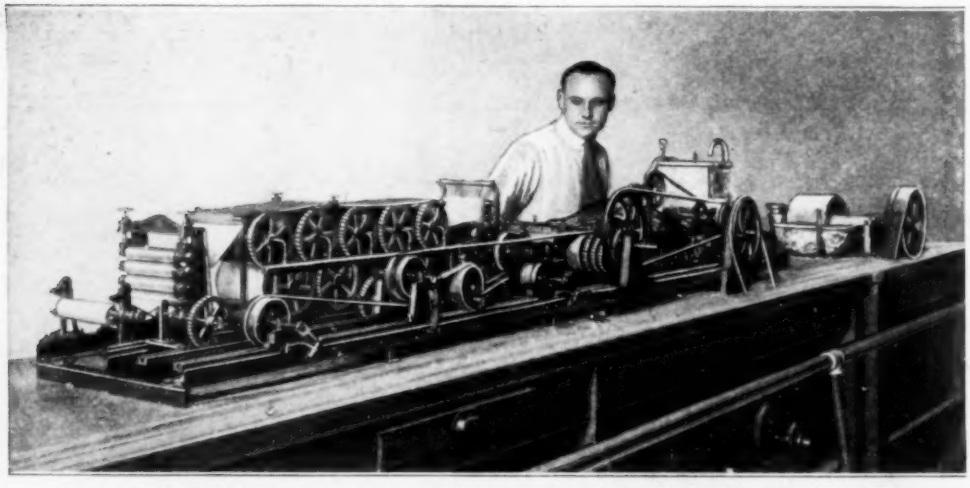
pressure, poise, engine revolutions, altitude, direction, angle of rudders, and so forth.

Within the envelope of the "ZR-2" was a ventilated passageway extending the full length of the frame. This furnished room for the storage of fuel, water and ballast tanks, and dining room and quarters for officers and crew. From it ladders led to each of the cars. Two other ladders led to the top of the envelope, where platforms for making observations and mounting guns were provided.

As a home for its first aerial dreadnaught, the navy has built a hangar, at Lakehurst, N. J., which is the largest and most complete in the world. This hangar is 943 ft. long, 200 ft. high from the ground to the monitor on its top, 350 ft. wide, and incloses 50,000,000 cu. ft. of space, about seven times the 7,250,000 cu. ft. inclosed by the Woolworth building. The available balloon space is 803 ft. long, 262 ft. wide, and 178 ft. high, sufficient to accommodate three ships of the "R-34" type, two of the "ZR-2" type, or one of 12,000,000-cu.-ft. capacity, which has been considered a possibility. Two battleships like the U. S. S. "Montana" might sail abreast through it with a clearance of 40 ft. The framework is of steel and concrete. To cover it, 4.5 acres of asbestos shingles, 2.1 acres of steel sash, and 5.09 acres of patented roofing were used. Our future lighter-than-air craft will be built here or at one of two other hangars to be constructed, one at Cape May and one on the Pacific coast.

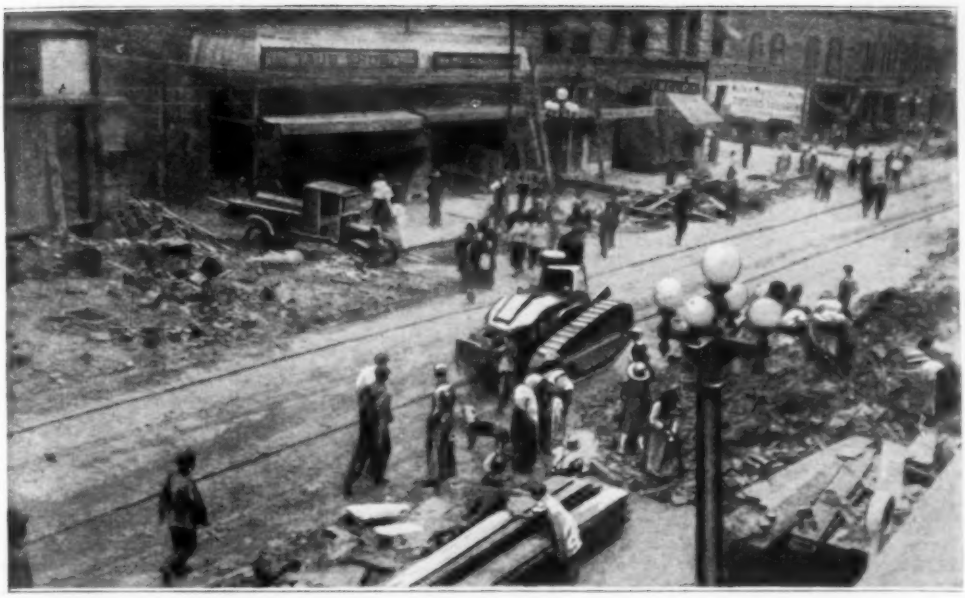
The Lakehurst hangar has an electric generating plant which will produce 60,000 cu. ft. of hydrogen a day for inflating the dirigibles. It also has a system for storing 1,000,000 cu. ft. of hydrogen compressed in tanks, and inflating from the tanks. Because of the danger of escaping gas, there are no wires or exposed lighting connections within the shed. All lighting is through heavy glass covers in the walls, floor, and roof, with the connections outside the structure, and with gas-proof covers. The skylights are made of glass which will cut out light rays detrimental to the envelope fabric.

Each end of the structure is closed by two-leaf rolling doors, 177 ft. high and 136 ft. long. These are electrically operated by four 20-hp. motors, and run on standard-gauge tracks. Docking rails run through the building and extend out 1,500 ft. at each end. The entire landing field comprises about 1,400 acres which have been cleared and graded to permit safe landing. A battery of six searchlights is mounted on each corner of the roof. The building contains a woodworking shop, machine shop, balloon-fabric shop, drafting room, photographic room, supply room, cafeteria, baths, and offices.



WORLD'S SMALLEST PAPER-MAKING MACHINE ON EXHIBITION IN CHICAGO

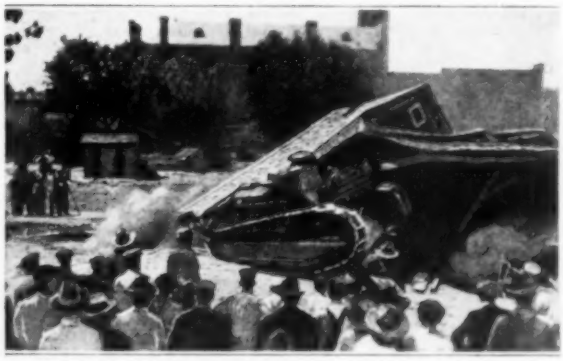
THE business of paper making is usually left to machinery of enormous size and capacity. The great white rolls often seen about the printing plants of newspapers and publishing houses, are most often made on a machine whose over-all length would be nearly 200 ft. and its weight many tons. Paper making has been done on a much smaller scale, however, as has been demonstrated by a machine used for show purposes during the Graphic Arts Exposition held in Chicago recently. This diminutive paper manufacturer is less than 9 ft. in length and has some bearing parts which are comparable in size with those used in a watch. It includes all the operations for making paper from the time the pulp is fed to the grinder to the rolling of the chalk-white finished stock. The completed roll is only 4 in. wide but of standard grade and quality.



Seven Army Tanks were Put on the Job of Wrecking after the Recent Flood in Pueblo, Colorado. The Business District Was a Litter of Ruined Buildings, but the Tanks Made Short Work of Cleaning Up. One of Them is Shown Here Hauling Wreckage through the Street

PUEBLO'S WRECKING AND SALVAGING METHODS

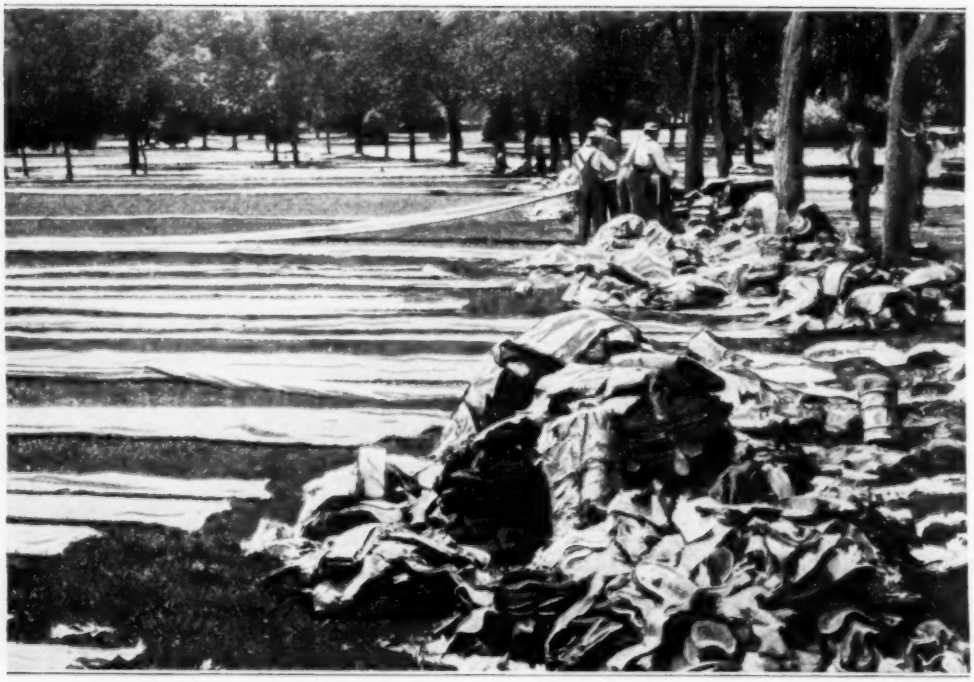
FOLLOWING the flood which swept through the business section of Pueblo, Colo., on June 3, many buildings were left standing in a dangerous condition. The government, taking charge of the restoration work, sent seven army tanks for use in wrecking. In most cases the tank crews hooked steel cables about the shaky walls and pulled them down. Where that was impossible, they plowed through the building and butted it down. They hauled complete houses out of flood-made lakes and dragged freight cars out of the mud to the railroad tracks.



A Single Tank Attacked the Ruins of This Building. Clearing It Away would have Required Several Days with the Ordinary Wrecking Gang, but the Tank Handled It in Hurry-Up Time

Here the Tank has Completed the Job Shown in the Preceding Picture and Is Ready to Move on to Another. The Work of the Tanks Attracted a Crowd of Interested Spectators

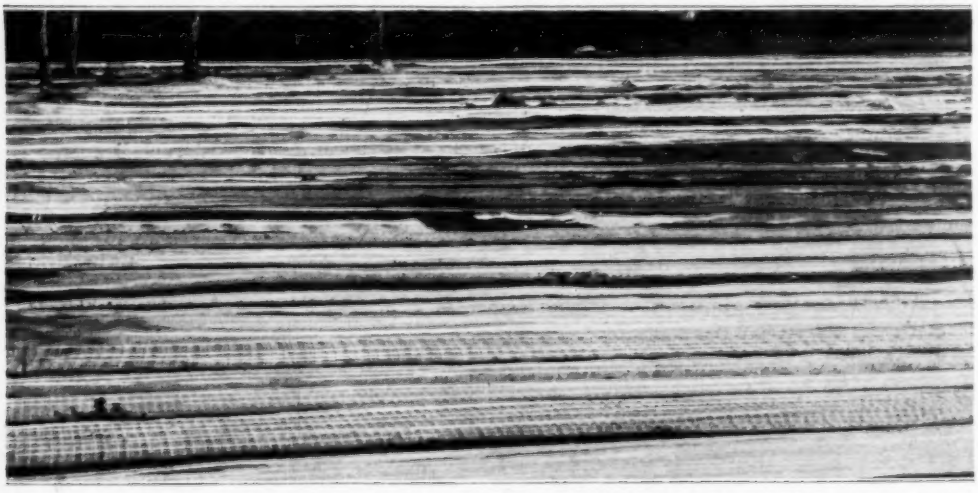
To the owners of the wrecked stores, stocks of mud and water-soaked goods looked like a total loss. If not cleaned and dried immediately, they would soon mildew and rot, but as the city water mains were out of commission, washing seemed impossible. A clothing buyer in one of the department stores found many garments that were comparatively



All the Water-Soaked Goods Which Were Not Muddy were Hauled from the Stores to the Parks by Trucks. Here, by Permission of the City Authorities, They were Unrolled and Stretched on the Grass to Dry. Muddy Goods were First Washed and Then Dried in the Same Way

clean. She secured tubs and a wringer and started squeezing the water from these clothes. Soon she had a tubful of passably clean water and was ready to wash out the mud-stained goods. Others followed her example, and before long salvaging was well under way.

The city authorities gave permission to use the parks for drying salvaged merchandise and many acres were covered with fabrics. For 22 days the work continued, aided by the dry Colorado climate. Sold to a wrecking house, the goods would have brought only a small part of their original value. Washed and dried, they were worth $125,000 to one store.



Many Acres of Parks and Lawns were Covered with Drying Merchandise for Several Weeks. The Dry Climate Made It Possible to Salvage a Large Part of the Damaged Goods Before It could Mildew. In This Way Pueblo Merchants Saved Hundreds of Thousands of Dollars' Worth of Stock

COMMENT AND REVIEW

[These pages were printed August 25, 1921.]

INFORMATION from Washington indicates that the Blue Sunday Law advocates are not intending to let any of the blue fade on account of lack of effort. Their propaganda and lobby works at the capital city are being overhauled and put in good working order for the winter. They announce an active campaign, backed up by open threats of loss of votes at home, against congressmen and senators who refuse to be dictated to and vote contrary to the schemes of the fanatics who seek the salvation of the multitude through solons.

Sunday "Reformers" Working

Probably the three high points, most offensive in their nature, are the complete stoppage of all railroad functions from Saturday midnight to Sunday midnight; the abolition of all newspapers on which any work of preparation or distribution is done during the 24-hour "closed season"; and the use of automobiles for any other purpose than to attend church.

Probably, for obvious reasons, no mention is made specifically of the telegraph and telephone service, but they are included in the blanket wording that prohibits any person from exercising his ordinary vocation on Sunday.

If any one thing would be calculated to breed disrespect for law, it is such a blue law as proposed. It does not seem possible that our jails, which are rapidly becoming depopulated, could be made to hold the intentional and unthinking violators of the proposed law.

Every schoolboy knows what happened to Rome when the senate undertook to do the thinking for the empire. As President Harding so timely suggested in his Plymouth address, the tendency of late has been to rush to Washington for things which properly belong to each state to determine for its own citizens. The evil of centralization in government is a growing and extremely dangerous one, which every thinking American should set his face and lift his voice against. Congressmen and senators will do well to remember that the threat which these narrow-minded reformers so confidently make of loss of votes at the polls is a two-edged sword; and only a pitifully small minority shares their extreme views. It would be helpful if they would select any city in the country of 5,000 or more, and if they could find one, have its city council enact the laws they would impose on the nation. Then both they and all of us could watch the experiment. If it proved to be the great advantage, and made for the better, happier lives they claim, the work of adding city after city would then be an easy task. Instead of being forced against their will, the others would insist upon having this great boon also, for the overwhelming majority of us all, everywhere in this country, is in favor of better, happier lives. Let them concentrate upon one community all the money and personal effort and advertising propaganda they are now directing against congress and the nation, conduct an educational campaign through churches, papers, open-air meetings, billboards, soap-box orators, and all that. When they have convinced and secured this one community to make the trial, and the country has had a year in which to observe the results, it will be a little more logical to ask the other 110,000,000 citizens also to consider the adoption of the proposed idea.

If, however, they cannot convince one single city of the benefit and desirability of their plan, would it not seem that they are more mistaken than earnest?

Candidate cities for the experiment are in order: which will offer itself for the ordeal?

A GENTLEMAN, who owned one of the large manufacturing plants in New England and employed large bodies of men for 30 years, and who was known as one of the successful men, retired. He had just turned over his responsibilities to younger men when we entered the war. He immediately offered his services as a dollar-a-year man, and on reporting for duty was sent to investigate a bad strike at a plant which was making parts of wheels for artillery. As only a few plants in the country were equipped for this work, it was of utmost importance that this plant resume production at once.

Will We Learn?

On arrival he found the men unreasonable in their demands and the employer equally stubborn. Each side declared it would

never yield. However, after three days of the hardest work of his life he restored harmony on a permanent basis, and the plant was humming merrily when he left. He returned to headquarters to report, naturally feeling well satisfied at his success in so short a time. He was asked as to what conditions he found and admitted they were pretty bad, but that he was able to straighten out all the tangle and had left everybody working and contented.

"But you were sent only to investigate, not to settle the strike; you grossly exceeded your authority. We intended to send another man to settle the strike when we had your report on conditions." And thereupon he was called down as he had not been in 40 years, and promptly resigned and sought another channel in which to help. His experience was duplicated hundreds of times. The incident goes to show how red tape robs men of ordinary common sense.

For many years the man with a new idea for Army or Navy has found his approach guarded and blocked. Seldom could he get beyond office clerks and subalterns. It was apparently assumed he was a crank with a wild idea, and too often he was humiliated and treated with contempt. He was sent from one to another according to the most approved political plan of "passing the buck." On more than one occasion his desire to give his own country the benefit of his invention was so thwarted and scorned that he was driven to sell his patent to some foreign country. There is little doubt that the disabling and deadly gases with which the Germans surprised, and for a time overcame, the allies were invented in the State of New York and refused by our government.

One of the greatest weaknesses of government has been its immobility. Little or nothing could be done without the sanction of some high official whom the inventor rarely was permitted to see. A corporation is successful partly because it has an open mind and ear to any suggestion for improvement, and is known to welcome such. Obviously, out of all the ideas presented, few are really practical or helpful to any corporation, and a great deal of threshing must be done to get the occasional grain of wheat. But they have men trained to listen, and even should one make an adverse report, the applicant can always go higher up, even to the president. Occasionally some one with a wider vision will accept what those below him have rejected. It rarely happens that a corporation permits a good idea to slip by because of any ethics of custom—corporation ethics are made to fit opportunities; not the reverse. Manufacturers realize that in order to find the gem, a lot of worthless stones must be examined.

Toward the latter part of the war some relaxation of ethics was observed with a corresponding increase in the exercise of good judgment. A further effort is now being made to cut out a lot of red tape and substitute practices without which corporations would go bankrupt. The reform deserves the moral support of every citizen. Departments have followed certain customs so long, clerks have been raised so persistently on red tape from young men to the retiring age, that the practice has become almost a religious fetish with them. To make any change seems as impossible as to throw out the whatnot, horse-hair sofa, and straight-back chairs, and to open windows and doors in a New England farmhouse parlor. But it must be done, and modern, efficient, economical, and expeditious ways substituted. It is to be hoped that inventors, while not being allowed to make a nuisance of themselves, may now at least receive a patient hearing and a suitable consideration of their ideas.

For What Is the College?

IF you ask the average college professor, "What is the province of your college or university?" his reply will be, "To educate young men—or women." Then should you persist and ask, "Educate for what?" his reply—unless it be some specialized school like law, medicine, engineering, etc.—would probably be, "For anything."

Put the question to alumni and they say, "The best function of a college is the wonderful lifelong acquaintances one makes, and the mental training; a graduate can go to nearly any civilized place on earth and find the companionship of men from his own college."

Fifty years ago, the saying in New England was, "A boy's life work should be determined by the time he is 14 years of age." This was manifestly illogical and has long since been abandoned, because very few at that age are

competent to decide for themselves, and to have some one else make the all-important decision is almost as bad as having one's wife chosen for him. Were this practical, however, the boy would have a very great advantage, for he could immediately commence preparation for his life work.

Time was when college graduates became chiefly professional men. Of late years the value of a college education for its own sake has graduated increasing numbers into commercial fields. Recognizing this, first several state universities arranged some studies and expanded others to constitute what is really a study of the ethics of business, finance, and commerce. While these courses, which differ little in various institutions, do not go into details of any one business—as an engineering course specializes in electricity or cement—they are calculated to impart an ability to recognize symptoms in finance which are of incalculable value. The surprisingly large enrollment for this course which both Yale and Harvard provided for the first time last fall, is very significant. It was a getting nearer to the vital thing.

A very successful business man, who has lived the past 40 years "next door" to a great university, and who has studied and watched the results of college life, said to one of its professors several years ago, when the latter was remarking on the completeness of their college work, "Yes, quite so, yet there are two courses I would add, even if they could not extend beyond a single year. One would be in business administration, and the other in tact, for if a young man has tact he will get along almost anywhere." The business administration has already become a fixture, and will doubtless ramify and expand, making a channel for itself quite as distinct as the classical or scientific courses.

Tact is a homely, old-fashioned word which deserves to be written high in a young man's career, for many a bank or railroad president, and other captains of industry who never had the advantages of college training, owe their success in large measure to the exercise of tact; which, after all, is only saying and doing the right thing at the right time, or even remaining silent.

One hesitates to suggest anything additional to the already overcrowded curriculum, but I cannot restrain the thought that the college course could preserve all its traditions, its acquaintances, its mental training and still do vastly more of a lasting, practical nature for the young man. Personal inquiry of a large number of college boys in three leading institutions, the past year, including all classmen from first year to seniors, disclosed the surprising fact that out of them all only two seemed to have any idea whatever of what they would undertake when they graduated; of what their life work was to be. As an illustration of the hope and confidence in oneself to do things, it was a beautiful example of young manhood. One junior would study architecture after college and one "thought he would go in with dad," who is a manufacturer, but was frankly doubtful whether he "would like it or not."

It does seem that if only something could be done at some time during the four years to help these splendid boys "find themselves," to help them arrive at what they are really best fitted for, the advantage would be inestimable. Their outside work would then naturally include the reading of accepted specialized publications in their chosen line, and at every opportunity observation of that undertaking, and conversation with men already successful in that field. They would absorb a vast amount of the history and technical operation of whatever it was during the most impressionable years of their life, and graduate with a very fair start at least in the ethics of their choice, and be welcomed instead of rejected when they knocked at the door of opportunity. Just how this can be accomplished is a problem for trustees and faculty, even at the expense of substituting it, if necessary, for something exceedingly good but less productive of lifelong results. It would seem to be no more difficult to learn to diagnose a young man's fitness for some one or two things, than to master the mysteries of Babylonian tablets or Egyptian scrolls, and vastly more productive of human happiness. Just how successful it is proving, time has not elapsed fully to determine, but several very large corporations now subject all applicants for employment to a written examination by trained psychologists in order to determine what branch of their work each candidate is best fitted for.

The world is full of examples of misfit lives, of men and women only moderately successful, or even failures at what they have drifted into, whereas it is pretty certain in all cases, and definitely so in a great many, that had they made the right choice of their life's work, they would have fared far differently. If, to a splendid

education this self-help to one's right life work could only be added, what a tremendous economic gain, and what a saving of misdirected effort!

This is not, as it might seem, an argument against college education; quite the contrary. It is rather an emphasis of the fact that, with all the magnificent buildings, endowed chairs, scholarly instructors, and all the expanded machinery of the modern college and university, they seem to have ignored the most important function of all: the decision of what the graduate will make his life work. The college cannot be expected to make the selection, but it would seem reasonable to have some system which would enable the student, certainly by the time he became a junior, to begin a serious consideration of this problem for himself, and dealing with hundreds of young men yearly, some one—like an experienced surgeon who reads the symptoms and knows the proper remedy—might learn to draw out a young man's inclinations and aid him in getting the proper angle on himself. Like a mathematics problem, not necessarily do it for him but show him how to do it himself.

Unquestionably the college graduate is better equipped in many ways to undertake anything that turns up; but college trustees do not attempt to fill professors' chairs that way; they try to find some one who is understood to have specially trained abilities, as well as experience in the subject for which the professor is to be chosen. Even assistant instructors are selected from those who have shown aptitude for some one special thing.

Then why not try, at least, to help the boy determine in time what he is most likely to succeed in as a man? What, after all, has any college to offer that compares with this one vital selection? We all know men, who graduated with honors, who today have become stagnant and ambitionless through years spent in occupations for which a grammar school would have supplied all the necessary education. What a tragic waste of mentality!

Our boys bring with them to their chosen college wonderful potentialities, almost like the unused power of the ocean tides. What undreamed possibilities for development!

I believe in the not distant future some leading institution will undertake this work; then others will have to follow. Could anything be more logical, or redound more highly to an alma mater?

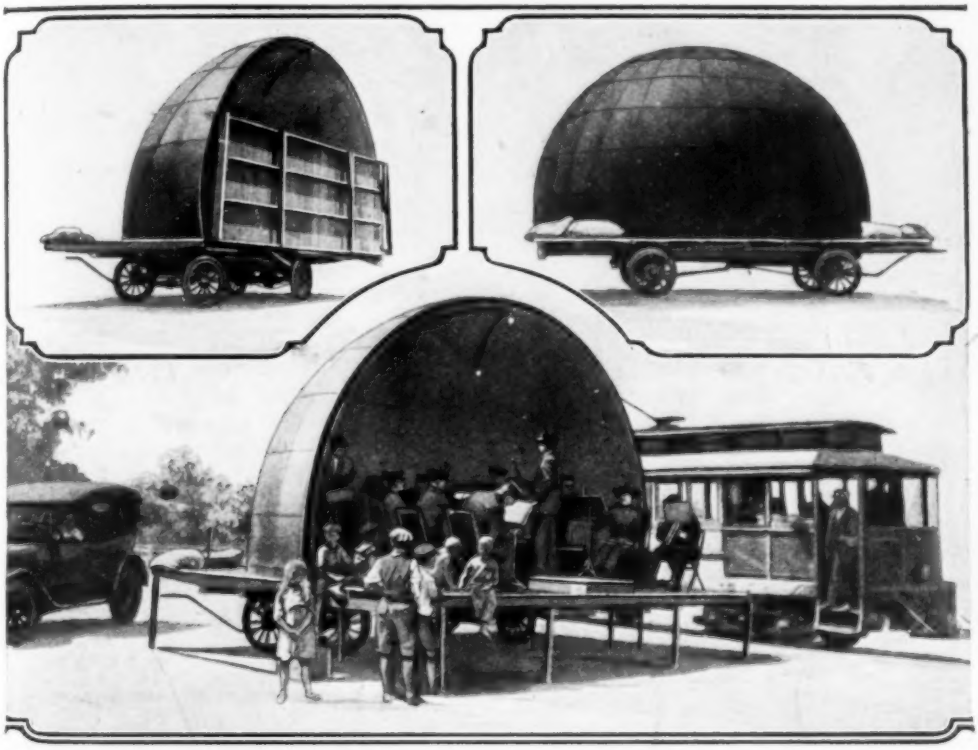
A Silent Tribute

I WAS deeply touched by a silent tribute observed recently while motoring through the state of Connecticut. It was late at night, and the inhabitants of the little village had long since retired; not a suggestion of life anywhere; the only sound the murmur of the motor, when my attention was arrested by the brilliant illumination of one of the customary "Rolls of Honor" erected throughout New England to honor the men who fell in the great conflict. The light was arranged to throw its rays directly upon the names of the heroes from that village. All through the long hours of the night, until relieved by the light of the rising sun, this illuminated tribute, as silent as those it commemorates, sheds its warm, friendly rays upon their honored names, keeping them ever bright in memory.

It was a simple thing, before which I reverently paused a few moments, yet like so many simple things it was beautiful. None of the names was known to me, yet somehow they seemed not far away. In rain and snow the light shines nightly like a lighthouse, as if to guide the beholder to the high ideals which prompted these young men to give their all.

Other cities and towns may well follow the example of this Connecticut hamlet, as an expression of never-dying gratitude from the older, and a patriotic inspiration to the younger generation.

H. H. WINDSOR



Three Views of a Portable Band Shell Used at Pacific Grove, California: Upper Left, Side View, Showing Shell, with Shelf Raised, Ready to Travel; Right, Back View; Below, the Band Seated in the Shell During a Concert. The Hinged Shelf Is Now Part of the Floor

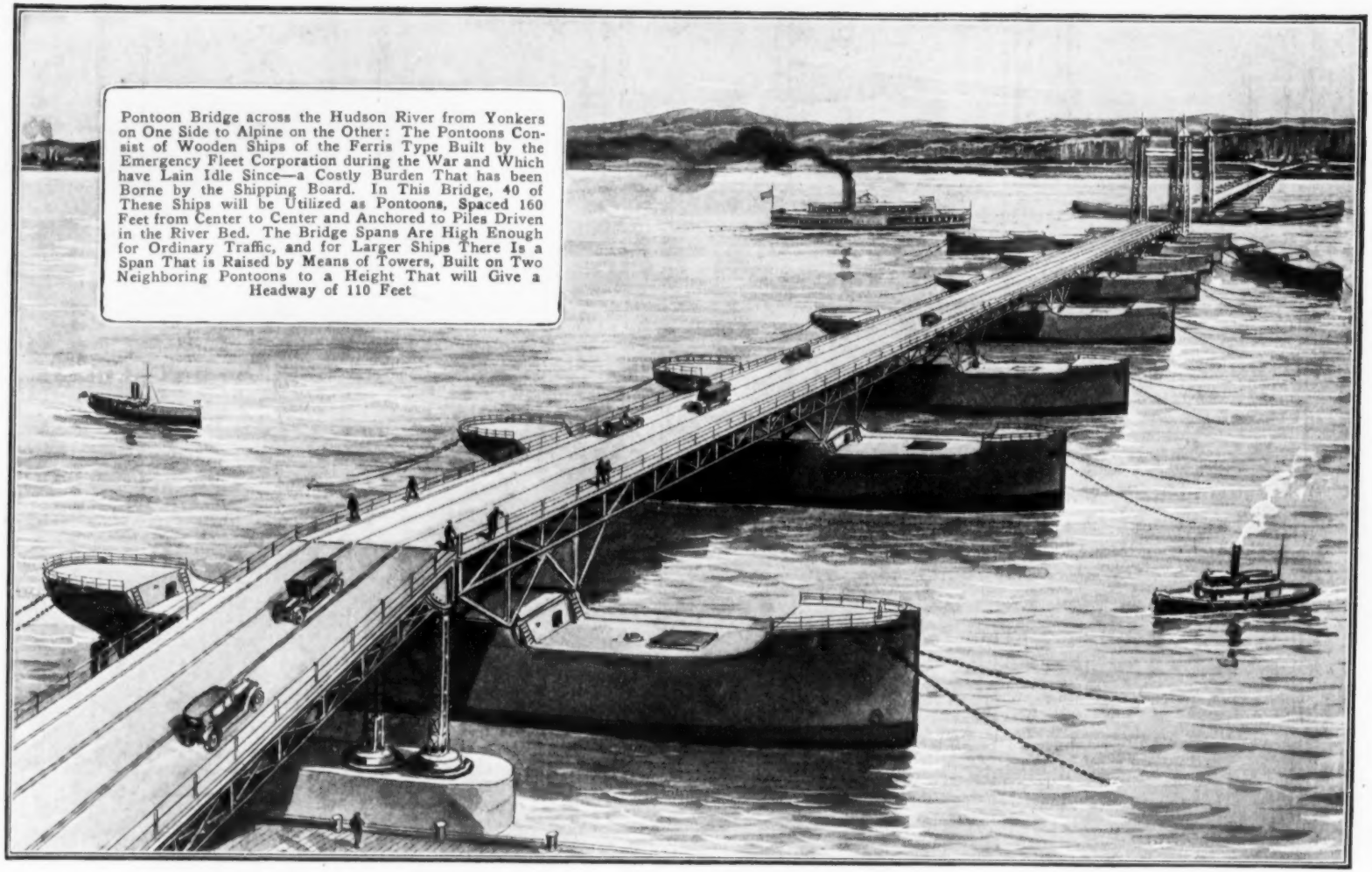
PORTABLE BAND STAND MOVED ON TRUCK

It is a common and usual thing for a band to go from place to place and give concerts. But to give concerts in a shell which they have brought with them for the occasion, as does one band at Pacific Grove, Calif., is indeed quite unusual. In this instance, the shell is mounted on a condemned fire truck and moves about from place to place between Pacific Grove and the beach near by, for use in concerts at different places. The shell floor is 20 ft. long with a 10-ft. radius. A shelf hinged to the shell, which may be raised while the truck is en route, provides additional space. Lighting and decorative effects add to the distinction of the portable concert platform.

¶ Bamboo has been found successful as a reinforcement of concrete piles for use along a Chinese railway. Four strips of green bamboo, tied together at 1-ft. intervals with square loops, also of bamboo, are placed at each corner of the pile and run lengthwise with it.

NEW SMITHING FORGE FOR VARIOUS OPERATIONS

A combination of forge, furnace, and blowpipe hearth is the latest English addition to the repair-shop accessories now on the market. The heavy metal stand supporting the hearth of the device contains a blowing mechanism, which may be operated by motor or by hand. The compressed air can be delivered either to the coke fire on the main hearth of the forge or to the tubes of a set of twin blowpipes, or to all three.



Pontoon Bridge across the Hudson River from Yonkers on One Side to Alpine on the Other: The Pontoons Consist of Wooden Ships of the Ferris Type Built by the Emergency Fleet Corporation during the War and Which have Lain Idle Since—a Costly Burden That has been Borne by the Shipping Board. In This Bridge, 40 of These Ships will be Utilized as Pontoons, Spaced 160 Feet from Center to Center and Anchored to Piles Driven in the River Bed. The Bridge Spans Are High Enough for Ordinary Traffic, and for Larger Ships There Is a Span That is Raised by Means of Towers, Built on Two Neighboring Pontoons to a Height That will Give a Headway of 110 Feet

PONTOON BRIDGE TO BE BUILT OF WOODEN SHIPS

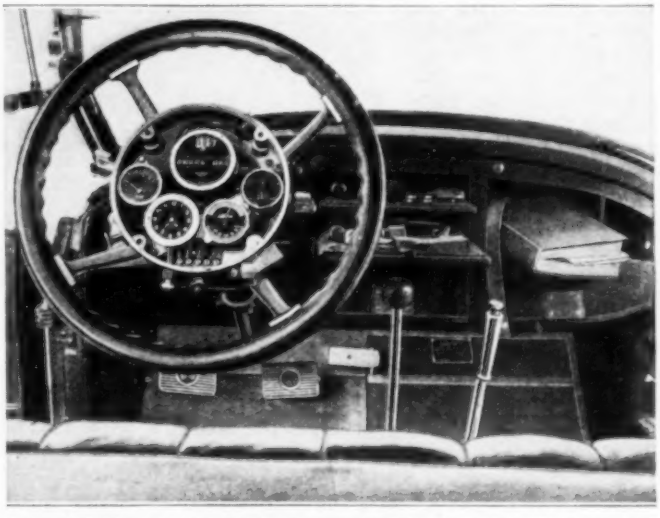
What to do with the 285 useless wooden ships built by the Emergency Fleet Corporation during the war has been for a long time a much discussed question. The utilization of at least 40 of them will be a welcome first step in the solution of the problem, and would, besides, be of immense service in one of the most densely populated parts of New York, if a proposal to build a pontoon bridge across the Hudson River, at Yonkers, materializes. The ships to be used as pontoons are of the type known as the Ferris, of which the Shipping Board has 180 available. The hulls are 268 ft. long; the beam is 45 ft., the depth 26 ft. 6 in., and the weight about 4,000 tons.

At the point of the river where it is proposed to build this pontoon bridge, from Yonkers on one side to Alpine on the other, the water is 40 ft. deep, and it has a tidal rise of from 4 ft. to 6 ft. and a current of from three to four miles an hour. The ships that will form pontoons for the bridge are to be spaced 160 ft. from center to center, and they will be anchored with cables to screw piles. The bridge spans will be in the form of steel trusses having a headway clearance of not less than 35 ft., sufficient for most of the river craft. For larger vessels there will be provided, by the erection of steel towers on the two boats at about the center of the bridge, means for lifting one span to a height that will give 110 ft. clearance. It is intended to build three roadways, each 10 ft. wide, and in connection with them two platforms for pedestrians. If it is found that this is insufficient for the traffic, other roadways will be added.

Pontoon bridges across wide rivers are no novelty. For many years there have been such bridges across the Rhine, at both Cologne and Coblentz. The only difference on the Hudson is a small tide, but this can be easily taken care of at the approaches. From the nature of its construction, the bridge is intended for temporary service, but it is estimated that a small toll will be sufficient to repay its cost in about 10 years.

MOTOR-CONTROL INSTRUMENTS ALL ON STEERING WHEEL

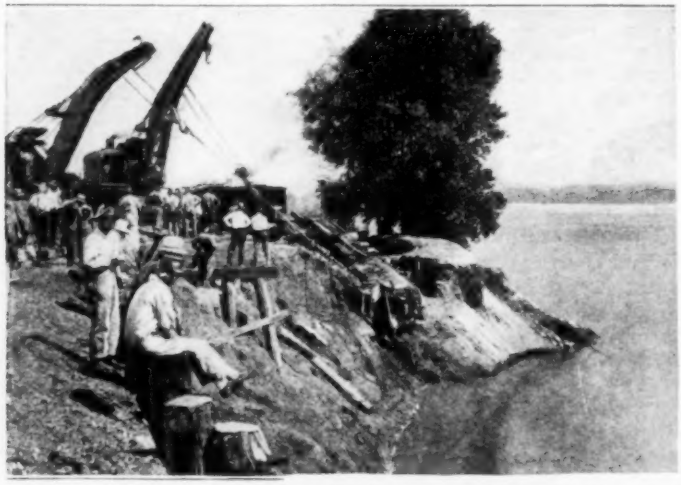
In a new automobile control all the instruments that are usually on the dashboard are compactly mounted at the center of the steering wheel in company with the spark and throttle controls. Everything in connection with the machine, including the lights, that has to be watched and occasionally handled, is as easily seen and reached as the spark and throttle controls. In one group, inside a circular frame and behind a glazed cover, are the speedometer, the ammeter, the motometer, a small clock, and the oil gauge, while around the frame, besides the usual spark and throttle controls, are the lighting switches, a horn button, and a stem for winding and setting the clock. Everything is equally visible and accessible. This arrangement eliminates a large amount of body wiring, all the wires being confined to a specially designed steering column, and all of the chassis wiring and other connections can be done at one time very conveniently, as they all lead to one point at the bottom of the steering column. The dash, whence the instruments have been removed, can be utilized as storage for tools, gloves, books, or anything else.



Automobile Control with All the Instruments Removed from Dashboard and Placed in One Group at the Center of the Steering Wheel

ENGINE DRAGGED FROM MUD GRAVE BY GIANT CRANES

Water undercut the right of way of the Chicago, Burlington, and Quincy Railroad at a point on the Missouri River near Kansas City, Mo., resulting in the dumping of an engine and a string of cattle cars into the river. Recovery of the engine was thought impossible by many experts as they viewed the spectacle and considered the conditions, especially as divers, after an underwater survey, reported the locomotive to be imbedded in quicksand on the river bottom. Nevertheless, a trial was made to get the engine out. A dredging boat was used to remove the mud and quicksand around the engine while hoisting apparatus was made ready above. Cables from two 100-ton cranes were placed about the locomotive, and as the lines began to pull, the engine lifted until finally it was landed on the bank. Three persons and a great deal of live stock died in the accident.



Pulling a Large Engine from the Mud Bottom of the Missouri River, near Kansas City, Missouri: Two 100-Ton Cranes were Used

A Suction Dredge Removed the Mud and Sand from around the Chicago, Burlington, and Quincy Engine Which Left the Road and Plunged into the River. The Water Was 30 Feet Deep

NEW FORM OF BLOW-OUT BOOT HAS POSITIVE LOCK

Adding 3,000 to 5,000 miles to the life of a tire that would otherwise be useless without expensive repairs, is the mission of a new blow-out boot. This boot has a positive lock made by inserting spearlike tongs into small slots. The tire is held tightly, taking the full strain of the air pressure. A rubber apron takes up the friction.

WATER-POWER DEVELOPMENT BEING PUSHED IN AUSTRALIA

Australia is paying considerable attention to the development of water power. There is now an enterprise under way for the erection of a 112-mile line, bringing high-tension electric current from a power station at Victoria Falls to Melbourne. The line, carrying a current of 132,000 volts, will be supported by 634 steel towers. It will furnish power that will be sold for manufacturing purposes near Melbourne. The contract, totaling $375,000, was awarded to an American firm.

INTERESTING FACTS ABOUT SPRAYING OF PAINT

Although it would seem that spraying of paint embodies all possible economies connected with paint application, the fact remains that its greatest economy is in the saving of labor. More paint is required by the mechanical process. An iron roof, when sprayed, will require 10 per cent more paint than if it were brushed, but the labor cost will be about 200 per cent greater in the latter case. For exterior brick walls the corresponding percentages are seven and 109, respectively. Interior ceilings and walls of plaster require 40 per cent more paint by spraying than by brushing, but a better hiding is achieved in the single coat. Brushing this kind of wall would require 160 per cent more labor with a poorer result. Although definite conclusions have not been reached, investigators incline to the belief that sprayed paint is more lasting.

NEW PORTABLE TYPEWRITER HAS STANDARD KEYBOARD

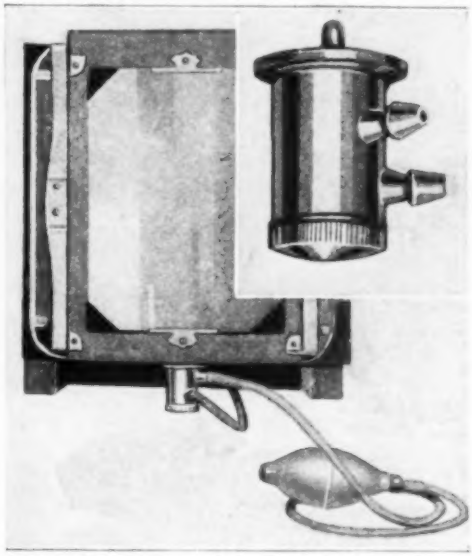
A new portable typewriter has a standard keyboard. All the keys are the usual distance apart, and the spacing of the rows conforms with that used in the desk-type machine. A simple ribbon color shift is provided. The carriage rides on roller bearings and moves back and forth in operation instead of up and down. It also locks when the carrying case is locked over it. The typewriter is permanently mounted on the bottom half of the case and is designed to facilitate operation

Two Views of the Portable Typewriter: Above, Ready for Use, with Type Bars Raised; Below, with Cover, Showing Type Bars Depressed

from the knees of the operator. Including the carrying case, the new machine weighs 11 pounds.

SHUTTER CONTROL AT REAR OF CAMERA SAVES TIME

Compressed air has been in use as a medium for closing the camera shutter for a long time, but now comes a new



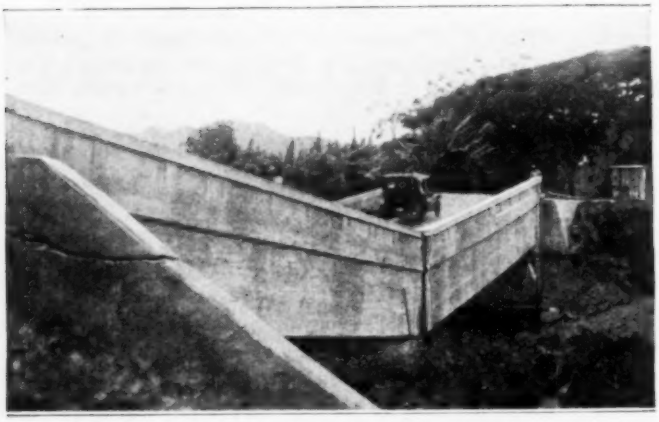
The Tiny Air Cylinder Closes the Camera Shutter Automatically When the Plate Holder is Inserted. Insert: The Cylinder, with Outlets to Bulb and Shutter

application in that connection as a positive control. This control is in addition to the usual shutter cylinders. It is attached at the rear of the camera at the bottom of the ground-glass plate-holder carriage. It comprises an air cylinder with a plunger and two outlets. One outlet is connected by tubing to the shutter apparatus. The other is connected to the bulb. When the plate holder is placed in the carriage, the stem of the plunger, which protrudes from the cylinder end, is depressed by it, and an air impulse sent to the shutter cylinders. These receive the impulse and close the shutter until the depression of the bulb opens it again.

WHITE SMOKE SCREEN NOW INSTEAD OF BLACK

Members of the Reserve Officers Training Corps at Camp Meade were much surprised recently when smoke-screen candles which they expected would send up black clouds produced white instead. Government experts have accomplished the color change by means of a new secret chemical combination. The white clouds are not sickening, and they form a better protective screen.

FLOODS BREAK HAWAIIAN BRIDGE IN TWO

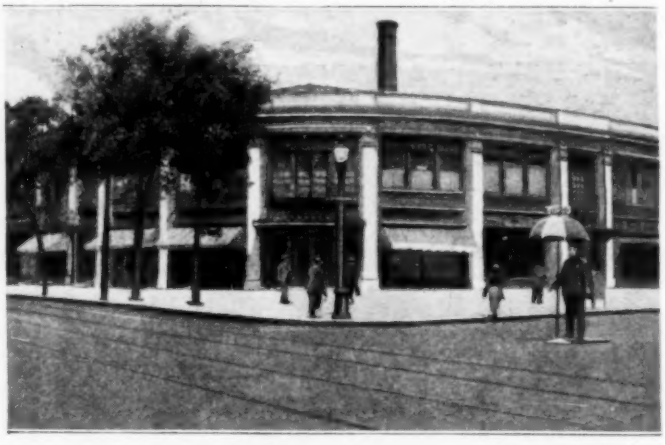


Rushing Flood Waters Undermined the Center Pier of This Hawaiian Bridge. It Crumpled in the Center and Three Months were Required to Repair It

A beautiful concrete bridge in Oahu territory of Hawaii was recently the victim of terrific floods. The rushing waters undermined the center pier and prevented it from giving the long concrete span any further support. The span then cracked across the middle and both the new ends sank together. Three months' work, including the raising of the structure with hydraulic jacks and rebuilding the damaged center pier, were required to put the bridge back into usable shape.

ROUNDED-CORNER BUILDING HAS ADVERTISING ADVANTAGES

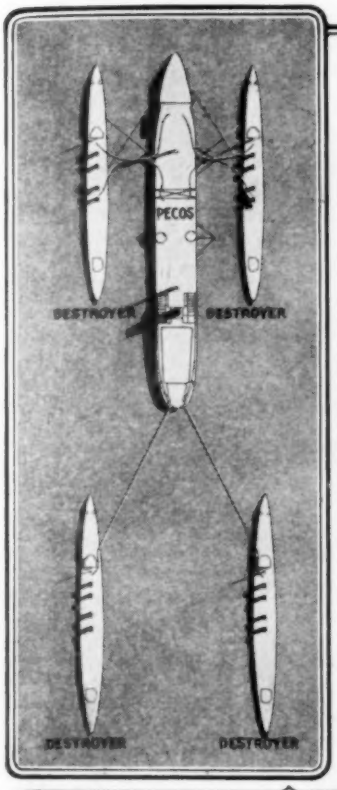
The round-corner building is now coming into use at several of Buffalo's busiest suburban street intersections. In each instance the structure is rounded off far enough back to afford more than one tenant corner advantages. First-floor space is taken up by retail stores, restaurants, and branch banks; and the second floors are occupied by professional men.

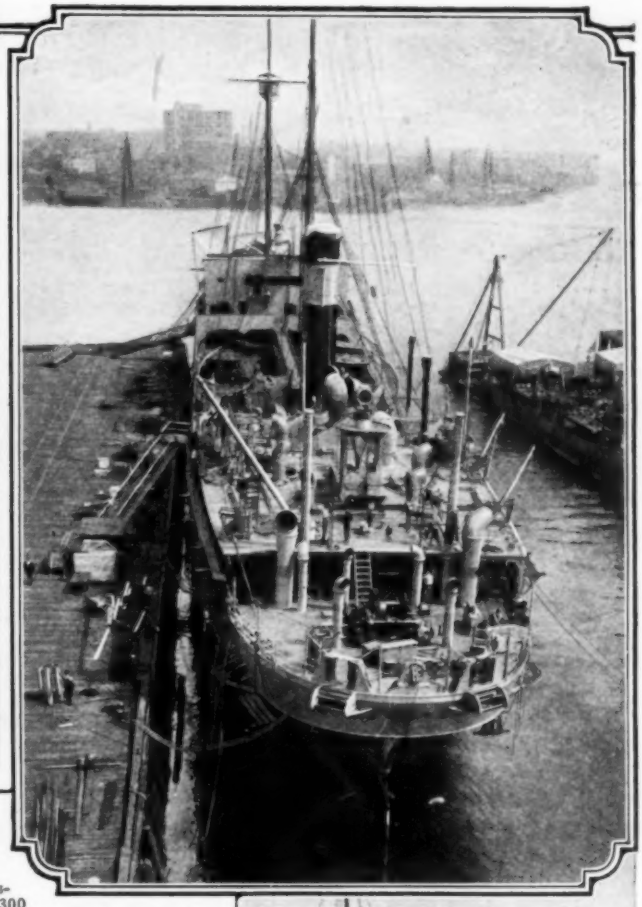


Rounded Form of Corner Building at a Street Intersection in Buffalo That Gives Tenants Two or Three Fronts for Show Windows and Illumination: The Buildings Are Mostly in Two Stories, the First Being for Stores

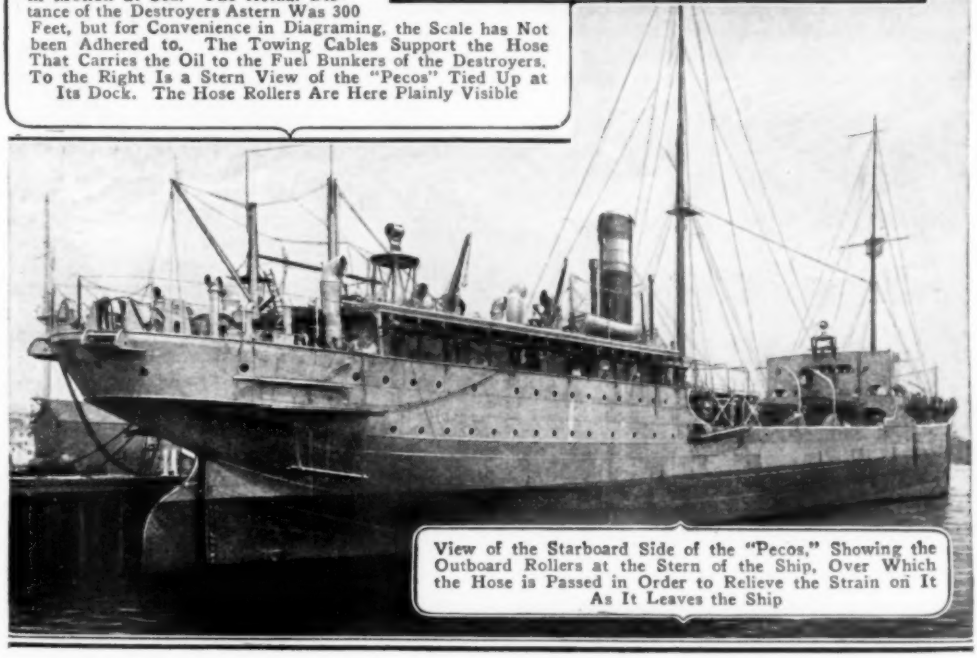
BUNKERS FOUR SHIPS AT SEA SIMULTANEOUSLY

The new U. S. S. "Pecos" can supply fuel oil to four vessels at the same time, while in motion at sea, bunkering two vessels from the stern and two from the sides. Because the towing distance of 300 ft., in the stern method, produces great strains in the hose and equipment, the greater problem is offered there. The hose—each section fastened to a 1-in. wire cable carrying trolleys—is brought from specially constructed storage skidways by means of an overhead trackway. The fuel ship is connected to the towed ship with a 1½-in. towing cable, and this is used as a track for running the hose over to the towed ship, the hose still carrying the trolleys. In leaving the fuel ship, the hose passes over heavy rollers, 41 in. long and 12 in. in diameter, designed to carry the great weight. The side method is preferred, but owing to the closeness of the ships this can be used only in reasonably fair weather. After fastening the vessels alongside, the hose is passed over a 30-ft. boom and brought to the towed ship by means of specially designed carriers. The fuel ship makes six to seven miles an hour while oiling.





Above: Diagram Showing Both Stern and Broadside Methods of Fueling Four Vessels Simultaneously by the U.S.S. "Pecos," While in Motion at Sea. The Actual Distance of the Destroyers Astern Was 300 Feet, but for Convenience in Diagraming, the Scale has Not been Adhered to. The Towing Cables Support the Hose That Carries the Oil to the Fuel Bunkers of the Destroyers. To the Right Is a Stern View of the "Pecos" Tied Up at Its Dock. The Hose Rollers Are Here Plainly Visible



View of the Starboard Side of the "Pecos," Showing the Outboard Rollers at the Stern of the Ship, Over Which the Hose is Passed in Order to Relieve the Strain on It As It Leaves the Ship

The Donkey Engine Which was Used to Move a 315-Ton Redwood Tree, in an Upright Position: This Feat, Which was Successfully Accomplished by California Lumbermen, has Never been Equaled

GIANT REDWOOD TREE MOVED IN UPRIGHT POSITION

By OSCAR C. DAVIS

A GIANT redwood tree, 210 ft. high, weighing 315 tons, and containing 63,000 ft. of lumber, was recently moved 20 ft., in an upright position, by California lumbermen. It is claimed that such a feat has never before been accomplished in the history of the logging industry.

The loggers wished to use the tree as a lead pole for pulling in large logs and loading them onto flat cars at the terminus of the logging road, but it stood 20 ft. from the right of way and it was not practicable to move the tracks. Experienced lumbermen said the tree could only be moved by felling it in the ordinary way and then raising it where it was to be used. But the company decided to attempt to move the tree in an upright position to the proper point.

The Butt of the Giant Tree, Shown Here with the Hold-Back Line Fastened around It, Measured 10 Feet Through. The Men Are the Two Loggers Who Did the Work of Moving

The trunk of the tree was first guyed with six 1¼-in. wire cables and then sawed halfway through on one side, and the half stump was blasted away below the cut. Skids were placed under the edge of the butt, the rear guys slacked 2 ft., the front guys drawn taut, and the trunk sawed clear through. Then by a process of tautening and slackening the guy lines, a very powerful don-

key engine moved the tree to the desired position where a hole had been dug to receive it. Guy lines were attached two-thirds of the way up the trunk and tightened to prevent buckling under great strains. Pulleys were then attached at the top, and the pole was ready for work.

ENGINE THROWS COW AGAINST SWITCH—TRAIN DERAILED

An unusual accident recently happened to a fast Missouri Pacific train, near Malvern, Ark. The train was traveling at a 50-mile-an-hour rate when the engineer saw several cows on the track ahead. He blew the whistle to frighten them off the tracks, and applied the airbrakes, but was unable to stop quickly enough. The train struck one cow while still traveling at practically full speed, and threw it against a switch stand. The blow opened the switch, and the engine broke loose. Nine cars following it took the switch and were derailed; three overturned and two shot off to the side of the right of way. This was the only place on the entire system where such an accident could have occurred. Trains do not pass any other switch at full speed.

BERRY PICKING MADE EASY BY SIMPLE INVENTION

Much of the slow, tiresome work of berry picking has been eliminated by a recently invented device which is now being manufactured. The picker is a metal scoop similar to an ordinary flour scoop except that the bottom, which is flat, is composed of wire teeth. These teeth extend to within about an inch and a half of the back of the scoop. From there a solid bottom forms a sort of cup to catch the berries as they are scooped off the bush. The picker is suitable for picking blueberries, cranberries, and huckleberries.

¶Seaplanes were used extensively last summer for social purposes by the members of the Adirondack summer colonies. On some of the lakes there was in effect an air-taxi service. Perhaps in another season visiting by air craft will have become a quite commonplace pastime.

TESLA COUPLER GIVES GOOD RESULTS AS RADIO AERIAL

A complete radio receiving station, making use of a Tesla induction coil, in place of the usual plain frame aerial, has been placed on the market by a French company. The set consists of the Tesla coil, a tuner, and an amplifier. The first-mentioned has three coils of wire. The two inner ones revolve independently, one within the other, while the outer one is fixed. The three are supplied with the necessary switches, and the two inner ones are also provided with knobs for use in handling them. Good results are obtained with the set, especially in eliminating stations using the same wave length.

This Radio Receiving Set Uses a Tesla Coupler As an Aerial. The Direction Principle is Applied by Revolving the Inner Coils

WINDSHIELD GLARE REMOVED BY SPRING-ROLLER SUNSHADE

A shade, which is fastened to the upper part of the windshield, removes the glare of the sun on the glass from the driver's eyes. It is operated like the ordinary window shade by drawing it out of a case carrying a spring roller. The shade is pulled across the shield and is fastened with a small hook. The roller case is easily attached to the windshield frame with hooks.

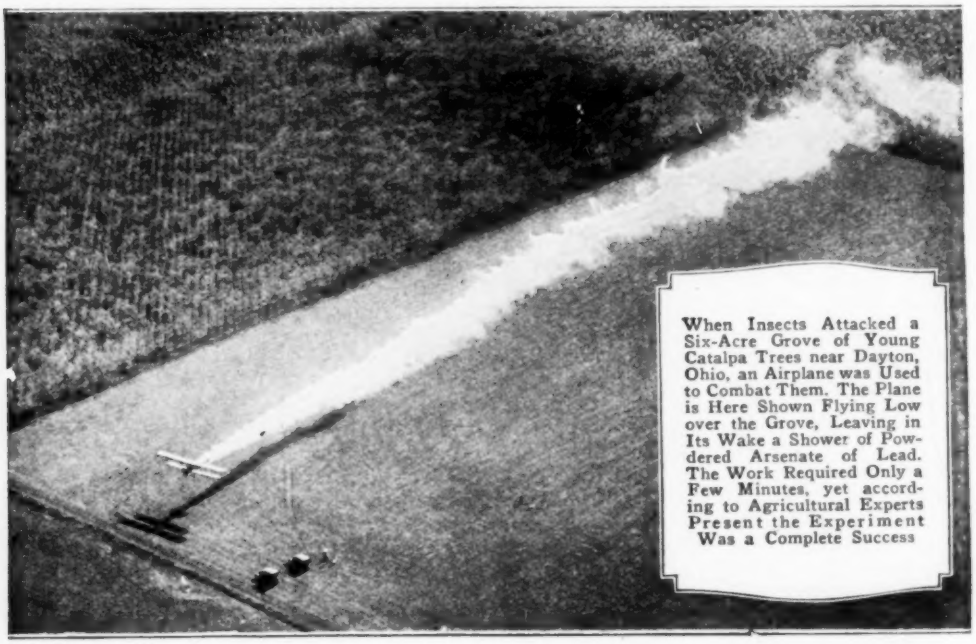
NEW ICE-CREAM FREEZER IS INSTANTANEOUS IN ACTION

Making ice cream at home will be easier than it has been if a newly designed freezer is used. Instead of cranking for a long time against the resistance of the thickening cream, it is now only necessary to spin the crank a few times and scrape off the ice cream. The new freezer is merely a drum for holding ice and rock salt, and a pan for holding the cream mixture. When the drum is turned, its surface becomes coated with a thin layer of cream from the pan below, which immediately freezes. After about 30 seconds a substantial quantity of ice cream may be scraped off the drum and collected in a special receptacle, which itself acts as scraper.

Ice Cream is Made in 30 Seconds by Revolving the Drum through the Cream Mixture. Above: The Freezer Lid Up, Showing Scraper in Place

AIRPLANE USED TO COMBAT INSECT PESTS

Another experiment in the adaptation of the airplane to peace-time activities was recently made near Dayton, Ohio. A six-acre grove of young catalpa trees had been attacked by insects and was in danger of being destroyed. A hopper with a cranking device was attached to the fuselage of an airplane and the hopper filled with powdered arsenate of lead. The plane soared directly over the grove and the poison was sifted onto the trees with the aid of the air current from the propeller. Only a few minutes were required to accomplish this work, which would otherwise have demanded the services of a large number of men and sprays for several days, and, moreover, it was done more effectively by the plane.



When Insects Attacked a Six-Acre Grove of Young Catalpa Trees near Dayton, Ohio, an Airplane was Used to Combat Them. The Plane is Here Shown Flying Low over the Grove, Leaving in Its Wake a Shower of Powdered Arsenate of Lead. The Work Required Only a Few Minutes, yet according to Agricultural Experts Present the Experiment Was a Complete Success

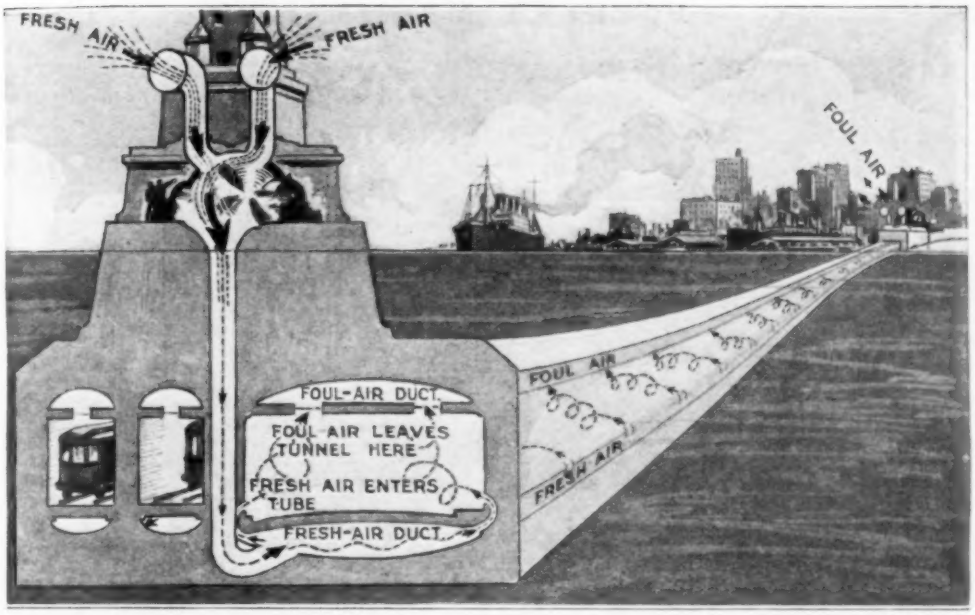


Diagram by J. Vipond Davies and Ralph Modjeski, Showing Their Combined Idea of the Manner in Which a Continuous Circulation of Fresh Air can be Made Possible in the 3,500 Feet of Tube Which Forms the Western Section of the Combined Tube, Bridge, Trestle, and Fill to Cross San Francisco Bay

COMBINED TUBE, BRIDGE, AND MOLE PLANNED TO CROSS SAN FRANCISCO BAY

By HARRY H. DUNN

WITH preliminary surveys completed and report rendered by two celebrated bridge and tunnel builders; with costs estimated and committees at work raising $150,000 for final surveys preparatory to actual commencement of the work, the long-talked-of bridge across San Francisco Bay seems now to be nearing realization. James Vipond Davies, of New York, and Ralph Modjeski, of Chicago, have just completed surveys, estimates, and reports, pronouncing the bridge to be practicable, and adding that the structure will pay for itself, basing their estimate of the earning power of the bridge on present traffic handled by the ferry lines. The plans of these two engineers have been submitted to the War Department by the general bridge committee chosen from all the cities surrounding San Francisco Bay, and as soon as they are approved by that department, they will be presented to the national congress. San Francisco, Oakland, Alameda, Berkeley, Emeryville, San Mateo, Richmond, San Leandro, and half a dozen other towns and cities on the eastern and southern shores of the bay, whose inhabitants total approximately 1,500,000, have joined forces,

BRIEF DETAILS OF THE BRIDGE ACROSS THE BAY OF SAN FRANCISCO

THE PROPOSED "BRIDGE" across San Francisco Bay, as planned by J. Vipond Davies and Ralph Modjeski, bridge and tunnel experts, consists of a combination of tube, bridge, trestle, and causeway, extending from a point between Mission Rock and Potrero, in South San Francisco, and the westernmost tip of Alameda, on the eastern shore of the bay. The distance from the city hall of San Francisco to the Oakland city hall, via the proposed bridge, is 9.38 miles, the air-line measurement being 8.31 miles. Of this distance, the combined tube, bridge, trestle, and causeway occupies 5.8 miles, divided as follows:

Tube, beginning at the San Francisco terminal and sinking to such depth as to give 40 ft. of water in the channel above it, 3,500 ft.

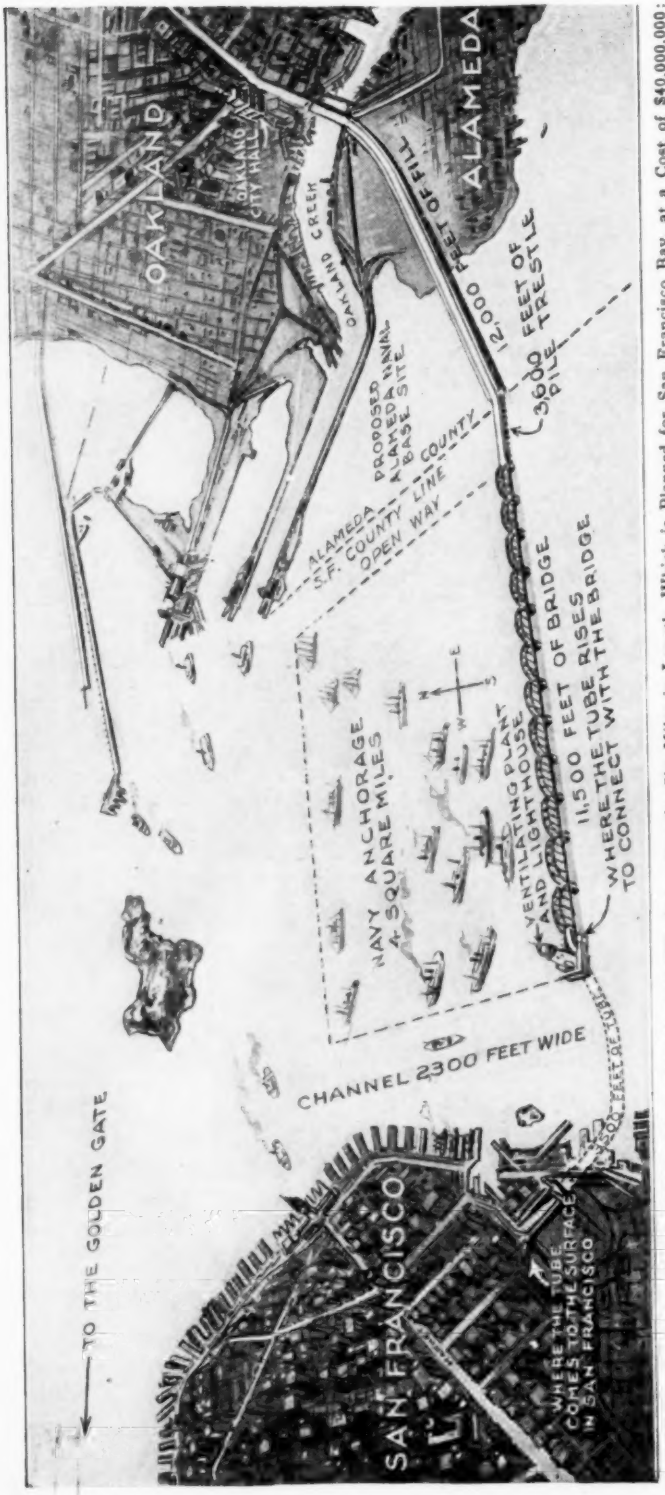
Bridge, beginning on an artificial concrete island bearing a lighthouse, at the outer end of the tube, 11,500 ft., divided into approximately 40 spans of 300 ft. each.

Trestle, extending from the eastern end of the bridge to the solid causeway, or mole, 3,600 ft.

Causeway, fill, or mole, from the eastern end of the trestle to the mainland of Alameda city, 12,000 ft.

Cost, approximately $40,000,000.

To be paid for by a toll system, probably five cents for each person using the bridge and 75 cents for each vehicle.



Relief Drawing of the Combined Tube, Bridge, Trestle, and Fill, Approximately Six Miles in Length, Which is Planned for San Francisco Bay, at a Cost of $40,000,000: Under the 2,300-Foot Channel at the San Francisco End will Pass Two Rail Tubes and One 20-Foot Vehicular Tube. These Connect with a 11,500-Foot Bridge Having Two Rail Tracks and a 40-Foot Roadway. A Long Pile Trestle and a Filled Approach Lead from the Bridge to Oakland

and committees consisting of men prominent in each of these cities have been named to arrange for raising the funds, first for the survey and second for the actual construction.

The maximum cost of the bridge is placed by Davies and Modjeski, in their official report, at $40,000,000, and the length of time necessary to construct it at three years and eight months. After careful studies and surveys, in which they were assisted by 18 engineers from cities located on the bay, the two experts decided that an unusual type of traffic carrier—a combination tube, bridge, trestle, and causeway—would best handle the 40,000,000 persons and the 750,000 vehicles which cross the bay annually. This combination provides for an open channel for shipping, more than 2,000 ft. wide, in the deepest part of San Francisco Bay, and along the waterfront of that city, unobstructed by piers, and with no draws to be opened or bascules to be raised for the passage of vessels.

The plan of the two engineers which, with some modifications as to the eastern-shore terminal, seems most likely to be accepted, contemplates a structure 30,600 ft. in length, approximately 5.8 miles. The span of the bridge, according to plan, from the city hall of San Francisco to the city hall of Oakland, the largest of the east-shore

Location of Eastern Shore Terminal of the Proposed Bridge across San Francisco Bay: This Photograph Made from an Airplane, Shows the City of Alameda. The Proposed Bridge Landing Is on the Vacant Space at the Extreme Left in the Photograph, Where the Land Projects Farthest into the Bay

cities, is 9.38 miles. The air-line distance between these two points is 8.31 miles. The plan purposes a San Francisco terminal between Mission Rock and Potrero, close to the Union Iron Works, in what is known as South San Francisco. The eastern terminal, since the tube-bridge-causeway is to cross the bay very nearly directly east and west, is on the outermost point of the waterfront of the city of Alameda, just up the bay from the proposed site for the naval base..

Leaving San Francisco, the traffic carrier, according to the Davies-Modjeski plans and report, dips to a depth beneath the bottom of the bay sufficient to give 50 ft. of water at mean low tide in a 2,300-ft. channel along the San Francisco waterfront. The tube continues eastward 3,500 ft. and terminates at an artificial island of concrete and steel, surmounted by a lighthouse, which forms the western base of a bridge. On this concrete island is located a ventilating plant to keep fresh the air in the tube.

The bridge, to be constructed of steel on concrete, will be 11,500 ft. in length and consist of about 40 spans of 300 ft. each, with clearance of about 30 ft., so as to give passage room for small craft and inland-waterways traffic southward on the bay and out to the San Joaquin River. A pile trestle, 3,600 ft. long, extends from the bridge across the open way to the shallow inshore waters of the Alameda County line. At the eastern end of this trestle a solid fill, causeway, or mole, is to be built, 12,000 ft. long, extending across the mud flats and lowlands of Alameda city to Oakland Creek, the estuary which separates Oakland from Alameda. The present bridge across Oakland Creek will handle the traffic from the proposed bridge, so that the $40,000,000 improvement really ends there.

Compared with the channels by which shipping enters and leaves other large ports, the proposed channel is rather more than average in width. The channel from Sandy Hook to the Hudson, by

which shipping enters and leaves the port of New York, is 2,000 ft. wide and 40 ft. deep; the East River at New York is 1,050 ft. between piers; the Boston ship-channel entrance is 1,200 ft. wide and 35 ft. deep; the Mississippi, at New Orleans, has a clear width of 1,800 ft. between six-fathom contours; the main channel entrance to Philadelphia is 1,000 ft. wide and 30 ft. deep; the entrance to the port of London is 1,600 ft. wide, at Tilbury, while at Greenwich, it is only 900 ft. wide; Liverpool port entrance is 3,300 ft. wide; the river Clyde, at Renfrew, port of Glasgow, is only 400 to 500 ft. in width; the Scheldt, at Antwerp, is now about 1,650 ft. wide in its widest part, but projected improvements will reduce the entrance width to about 950 ft.; the Elbe River, at Hamburg, is approximately 700 ft. wide, and the River Tyne, at Newcastle, is 1,000 ft. wide.

THE SAN FRANCISCO BRIDGE COMPARED WITH OTHER BRIDGES

WHILE THE ACTUAL BRIDGE section of the San Francisco Bay crossing project will occupy only 11,500 ft., or, roughly, two miles, of the six miles of total distance, this bridge will have spans which compare well with those of other large bridges. Present plans are to cover the distance devoted to bridge by about 40 spans of 300 ft. each. This compares with:

Suspension bridges: Brooklyn, center span, 1,596 ft.; Manhattan, center span, 1,470 ft., and Williamsburg, 1,600 ft. These bridges are all at New York.

Truss bridges: Montreal, Can., bridge over the St. Lawrence, 7,000 ft.

Girder-span bridges: St. Louis municipal bridge, three spans of 668 ft. each.

Steel-rib bridges: Eads Bridge, at St. Louis, three spans of 502, 520, and 502 ft., and the Niagara Falls bridge, with one span of 840 ft.

Cantilever bridges: Forth Bridge, England, two main spans of 1,710 ft. each; Blackwell's Island bridge, five spans, 1,182, 984, 630, 460, and 460 ft.

Swing bridges: Barton bridge over the Manchester, Eng., ship canal, 234 ft., and the bridge over the St. Lawrence, with a 500-ft. opening.

Bascules: Tower Bridge, London, center 200 ft., with two leaves of 100 ft. each.

Transporter bridges: Runcorn Bridge, over the Mersey River, Eng., 1,000-ft. opening.

While details of construction of both tube and bridge have been left to be worked out later, the reports of the engineers indicate that they consider one 20-ft. roadway for vehicle traffic both ways sufficient in the tube. For rail traffic, suburban electric trains, steam passenger and freight trains—the latter handled by electric motors, of course—two standard electrically equipped tracks are considered sufficient. The plans provide for a sidewalk of sufficient width, paralleling the roadway for vehicle traffic, though foot traffic doubtless will be light over the bridge and through the tube, because of the length of the passageway.

These lines will be continued in the same manner over the bridge, trestle, and causeway, and details of these sections of the combined structure also will have to be worked out by the engineers who take up the actual construction work. One of the problems of detail taken up by Davies and Modjeski, however, was the matter of ventilation of the tube. This will be accomplished by drawing fresh air into the tube from the concrete "island," 3,500 ft. out from the shore on the San Francisco side, where the tube ends and the bridge begins. The pumps for the pulling in of this fresh air will be housed in the base of a lighthouse, some 75 ft. in height, which will mark the outer limit of the deep-water channel. This air will pass beneath the railroad tracks, roadway and sidewalk, in the tube, entering it along the sides and going out through a foul-air duct in the upper part. The used air will be pumped out at the San Francisco end of the tube, the pumps at both ends thus keeping a constant current of fresh air passing through the tube.

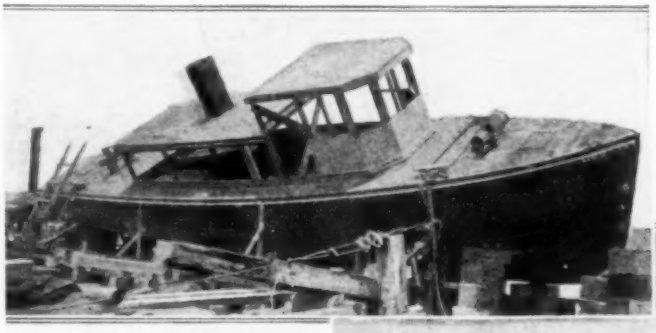
The engineers believe there will be a deficit between the net earnings and the fixed charges for the first three years, but that in the fourth year the bridge will show a profit, and thereafter will increase its annual earnings over expenditures. For the first year they estimate the income as follows: 20,000,000 passengers (half the average estimate), at 5 cents, $1,000,000; 750,000 vehicles, at 75 cents, $562,500; tolls from railway freight, $20,000; concessions from telephone, telegraph, electric-light and power, and other ducts, $10,000; a total of $1,592,500, or only a little more than half the necessary amount. By the end of the third year, they estimate the gross earnings will have risen to $2,850,000, while at the end of the fourth, this sum will have been increased to $3,317,500, and the fifth year will bring in a gross revenue of $3,630,000. Charges could then remain the same until deficits of the previous years had been paid off, when they could be reduced, until, it is thought, tolls at about one-half the rates proposed would suffice to provide the necessary sinking and maintenance funds. This scheme of financing the undertaking seems a feasible one, and promises to meet with general approval.

EARLIEST AND LATEST TRAINS AS THEY LOOK TODAY

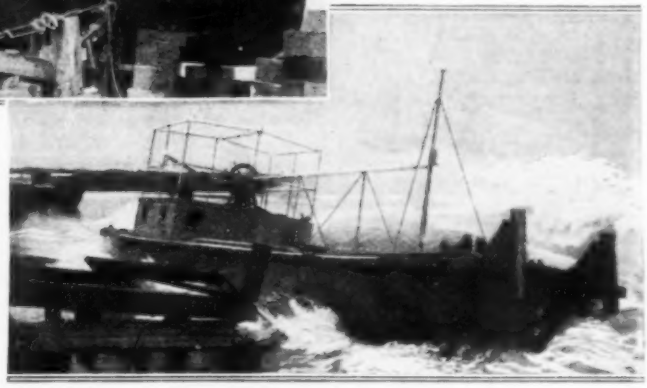
DURING the Pageant of Progress held in Chicago recently, one of the main attractions was the display showing the evolution of the railroad industry. Beside other features in this line, the earliest and latest trains were on exhibition. The little engine and train shown in the picture, is the De Witt Clinton, which made its first trip over the rails of the Mohawk and Hudson Railroad, Aug. 3, 1831. Its total weight is 12,008 lb., and it is about 1/17 as heavy as its neighbor, the Pacific-type engine attached to the 20th Century Limited of the New York Central Lines. The De Witt Clinton left New York under its own steam, but for the long journey to Chicago it was necessary to load it on a flat car. Arrived at South Chicago, the tiny relic was unloaded and allowed to run to Englewood, another suburb of Chicago, under its own steam. At this point it was hooked on to the record-breaking "Empire State Express" and pulled to the Municipal Pier for the pageant. The old locomotive is only 12 ft. 10 in. long and 8 ft. 5 in. high.

SELF-PROPELLED BARGE FOR MEXICAN OIL-FIELDS

There was launched at New Orleans recently an all-steel self-propelled barge for service in connection with the oil industry of Mexico. Although self-propelling, the vessel, as far as the hull is concerned, has all the characteristics of a barge. It is 54 ft. long, with a beam of 16 ft., draws only 3 ft. 6 in. of water, and has a capacity of 25 tons. The barge is equipped with a 60-hp. kerosene engine and has double rudders. A little later, and for the same service, a much larger all-steel barge was launched from the same yards. This is not self-propelling. It is 200 ft. long, has a beam of 42 ft., and a loading capacity of 9,100 bbls.



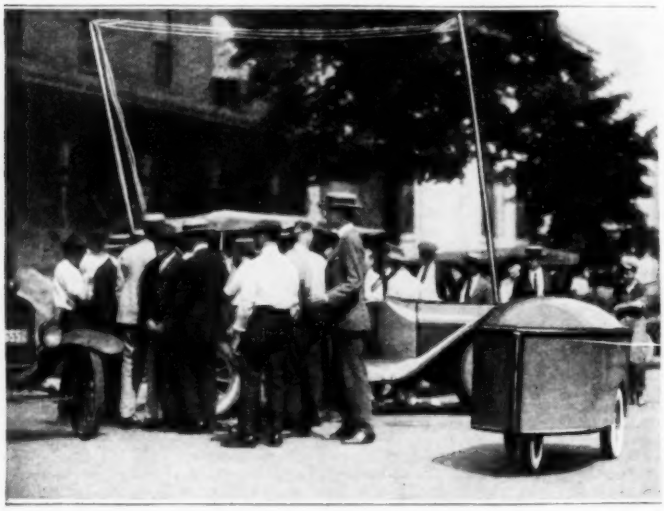
Steel Tug Built at New Orleans for Towing Barges That Are Not Self-Propelling, in the Mexican Oil Fields



The Launching of the All-Steel, Self-Propelled Barge That was Built in New Orleans for Service in the Mexican Oil Fields

ARMY DEVELOPS AUTOMOBILE CONTROLLED BY RADIO

A car, which is controlled entirely by radio, has been designed and built by Capt. R. E. Vaughn of the United States Army Air Service, at McCook Field, Dayton, Ohio. The car is electrically propelled by a motor and storage batteries, develops a speed of from 4 to 10 miles an hour, and is controlled by a special radio-sending instrument from any place on the ground, or from an airplane. Its range of operation, up to 50 miles, is limited only by its visibility from the point of control. A receiving instrument on the car is equipped with a "selector" which decodes certain dot-and-dash combinations and actuates the desired controls by completing electrical circuits. There are 12 controls, any one of which can be put into operation in less than one second from the pressing of the control button. This control system can be applied to anything which moves mechanically on the ground, in the air, on the water, or under the water. The application is of military value for directing tanks loaded with high explosives, and to set off the latter to destroy such objectives as machine-gun nests, ammunition dumps, and railroads. It can also be used for operating loaded boats or torpedoes against vessels. Airplane control will make certainty of results possible without the cost in lives which attends an ordinary attack.



A Cigar-Shaped Body Incloses the Delicate Mechanism by Which This Car is Controlled. The Automobile behind It is Equipped with Wireless Aerials and Instruments for Operating the Controls

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¶Cast electric steel tubing is now made by an ingenious new process. The steel charge is placed in a tubular mold, where it is melted by an electric current. It is then centrifugally formed.

The Radio-Controlled Car was Tried Out on the Streets of Dayton, Ohio. Spectators were Surprised at the Ease with Which It was Handled, Even on Crowded Streets. It was Stopped, Started or Turned as Readily as an Ordinary Automobile

A Disabled Plane, Forced to Land on the Lava Island in the Middle of Crater Lake, Received New Spark Plugs from Rescue Planes by Parachute. The Rescue Planes could Not Land on Account of Adverse Air Conditions. The Disabled Plane Got Out without Trouble

PARACHUTES RESCUE FLIER DROPPED IN CRATER LAKE

Wireless and aeronautic science were recently employed in a very timely combination which saved the life of an air-service cadet, flying from Mather Field, Calif., over Crater National Forest in Oregon. While in the neighborhood of Crater Lake, the spark plugs ceased working in the engine of his plane, and landing was necessary. Choice in landing places was confined to either the rugged mountain peaks below or a small island of black lava in the middle of the lake. After some deliberation he chose the latter and made a landing in the huge cliff-rimmed cup. The plucky pilot then set his radio outfit in operation and after many hours of waiting, rescue planes arrived carrying the necessary spark plugs. Adverse air currents within the great "moon hole" prohibited the descent of the rescuers, and so the plugs were attached to parachutes and dropped. After application of the new plugs, the pilot started his own engine and made a perilous take-off over the lake surface. Circling and dodging about in the twisting air pockets, the plane finally made its way westward over the crater side.

¶A species of oats found in Sumas Prairie, B. C., sprouted 17 stems with 100 oat kernels on each stem. The new species will be propagated further.

BASS DRUM CARRIES SNARE DRUM AND TRAPS

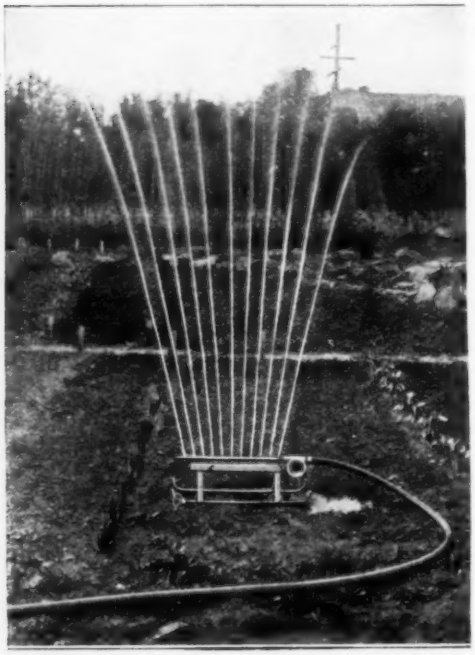
The hollow space inside a bass drum can now be used for more purposes than simply to provide resounding volume for each timely impact of the muffled stick. Its latest adaptation is to serve as a conveyance of the snare drum and the traps

The Snare Drum and All the Traps Go into the Bass Drum through a Special Door. The Door Locks and Is Concealed

that go with drumming. A concealed door, cut in the side of the drum, receives the articles and is closed tightly by a special latch. This improvement not only uses waste space but is of great convenience to the drummer in carrying his equipment from place to place.

MOTOR-OPERATED SPRINKLER WATERS WIDE AREAS

The water motor is brought into useful combination with sprinkling appa-



The Discharge Pipe of This Sprinkler is Rocked Back and Forth by the Water Motor at Its End. The Streams Spread 14 Feet

ratus in its adaptation to a light watering device recently designed. A small sled-like underframe, about 21 in. in length, supports the motor and water-distributing pipe. The latter is drilled with a series of small holes and is rocked back and forth by the motor. Pressure is furnished to the motor from the hose to which it is attached. The water thrown from the sprinkler will reach a distance of 14 feet.

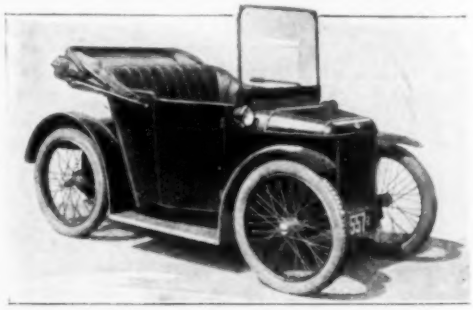
¶By contributions from the people of the state, Kentucky has been enabled to purchase the house in which Stephen B. Foster wrote the song, "My Old Kentucky Home." The purchase price was $50,000.

FIND METHOD OF PRESERVING NEWSPAPER FILES

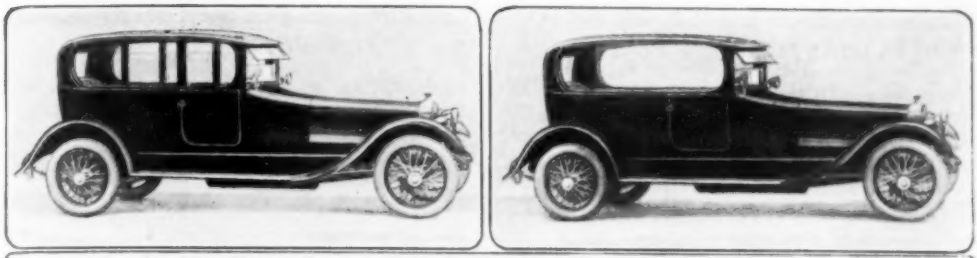
An effective process has been worked out for preserving newspapers. Since the introduction of wood-pulp newsprint, about 1870, newspaper files have rapidly rotted and become useless, probably owing to the chlorine in the pulp. The increased handling of papers during the war was so destructive that experiments in preservation were made in order that a permanent record of history might be kept. It was found that thin sheets of Japanese hand-beaten, fiber tissue paper, pasted over the sheets with rice paste, were the most satisfactory preservative. The paste is applied to the tissue and the news sheet is dampened before pasting. After drying, the sheets are pressed to reduce their thickness. Sheets so treated show even less wear than their buckram bindings. The tissue only slightly decreases the legibility, and the legibility improves with age.

SMALL ELECTRIC AUTOMOBILE IS PRACTICAL CONVEYANCE

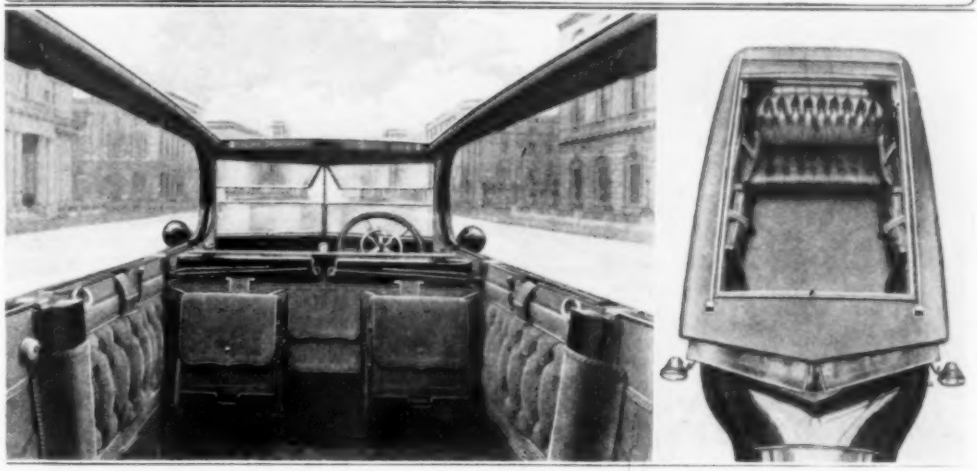
The latest development in electric motor cars is a tiny neat-looking conveyance which has been designed to furnish its user a means of transportation without the heavy upkeep cost of a larger car. The wheelbase of the new electric is only 65 in., and it is therefore desirable on crowded city thoroughfares because of its ability to make short turns. Fifty miles is the cruising radius on one charge at the speed of 15 miles per hour. Loads of bundles up to 500 lb. in weight are successfully carried. In motive construction, the new car is very simple, being a connection of battery to motor to rear wheel by roller chain. This little car is made up in models suitable for commercial, pleasure, and industrial purposes.



The New Electric Auto Is Convenient for Use in Heavy Traffic or in Industrial Plants



Two Views of a New English Luxury: Left, the Car as a Weatherproof Sedan; Right, the Same Car Arranged as an Open-Air Car. The Change is Quickly Made



Left: An Inside View of the New English Car. The Top has been Rolled Back after the Fashion of a Window Blind and the Side Doors Dropped into Side Slots. Right: Top View Showing the Open Top and Seating Arrangement

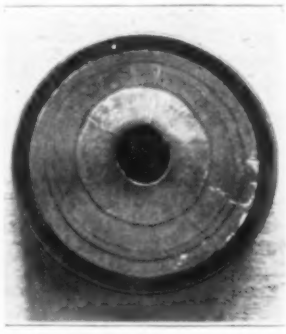
LATEST MODEL AUTOMOBILE HAS SLIDING ROOF

One of the latest developments in automobile luxury comes from English builders. Normally it looks like an ordinary sedan model, but it is so designed that the windows can be dropped into slots in the body of the car and the side pillars lowered in a few seconds. The top, which is made of flexible waterproof leather, slides back on spring rollers and disappears entirely in a rear cylinder, leaving no projection in the rear. The principle is similar to that of the roller blind. The roof is rigid in construction and the top edge presents an unbroken line without hinges or joints. The result is an entirely open car for fair-weather driving.

¶During recent competitions between destroyers, the flagship "Wickes" of the Pacific fleet took first honors. The "Zellin," running mate of the "Wickes," took second. The ships were judged for efficiency of operation.

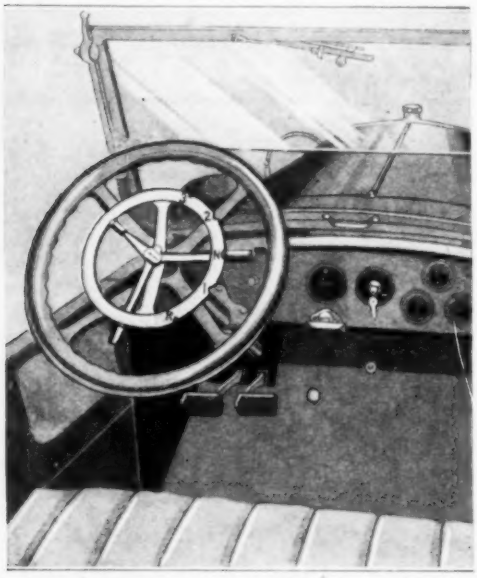
PIPE CLOGGED BY DEPOSIT OF MAGNESIA IN WATER

A peculiar situation was recently encountered by a Cuban firm. Within 18 months after laying, the water delivery from a 4-in. pipe line had decreased to a small fraction of the normal capacity. The entire system had to be taken out. On sawing through the pipe, it was found that the magnesia in the water used had formed a deposit on the inside of the pipe which was approximately 1½ in. in thickness. This deposit was a solid mass which completely closed all but about one-fourth of the opening.



GEAR-SHIFT LEVER OF AUTO IS ON STEERING WHEEL

In an automobile of recent manufacture, the gear shifting is done from the same ring as the spark and gasoline-lever adjustments are made. In changing from one gear to another, the clutch is operated as usual, and the lever on the steering wheel is used to change the gears as required. The emergency brake on the new car is operated by a pull-out lever on the dash. By these two changes, the footboard is relieved of two levers. The gear-position markings are lettered slots, and the shifting lever makes a ratchet fit in each slot.



The Gear-Shift Lever on This Motor Car is Extended from the Steering Post. The Gear Positions are Numbered and Notched on the Spark and Gas-Lever Rack

AIRPLANE SETS NEW RECORD FOR FUEL ECONOMY

What is claimed to be a new low record for fuel consumption was established by the Fokker limousine monoplane "Half Moon," in a flight from Washington, D. C., to Curtiss Field, near Mineola, L. I. The airplane, carrying five passengers, covered 275 miles, a distance greater than the railroad route. The time taken for the trip was about half of that required by the railroads. The cost of the oil and gasoline for the entire trip was $5.80, or about 2.1 cents a mile.

NEW TELEPHONE DEVICE TO LEAVE HANDS FREE

A device permitting the use of both hands while telephoning—an attachment which can be used with any telephone instrument—is now on the market. The receiver is clamped to the transmitter rod and a flexible tube, terminating in a cupped opening and adjustable to the speaker, is attached to the earpiece. A ball is hung on the receiver hook to hold it down. Placing the ball in a holder on the clamp releases the hook and makes the connection.

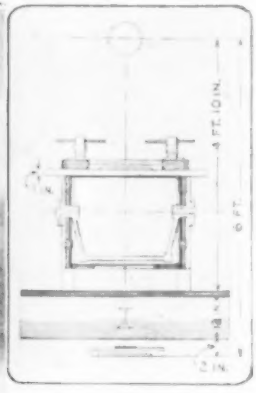
OBJECTS RADIOGRAPHED 85 YARDS FROM X-RAY TUBE

The X-ray kills for the same reason that it cures. Unless elaborate precautions are taken, it may do more harm than good. Its danger is from the penetrability of its rays, and some very interesting experiments have recently been carried out by a commission appointed by the French Academy of Sciences to determine just how far under differing conditions these rays can penetrate. It was thought at one time that a small thickness of lead, or a few yard lengths of air were sufficient to render the rays innocuous, but these experiments have shown that such is not the case. The tests were radiographic, and in one instance a negative was taken at a distance of 6 ft. from the X-ray tube, the rays having to penetrate 1 in. of lead, a marble slab, some wooden boards, and a floor 12 in. thick, and yet these rays were no stronger than those commonly used in X-ray photography. With the same strength a photographic plate was reached by rays after passing through a brick wall 20 in. thick, and a radiograph of a skull taken at a range of 85 yd. is comparable to one taken at short range.

The Scene in France of the Long-Distance X-Ray Photographic Experiments: The Dotted Line Shows the Path of the X-Rays from the Building on the Left to the Building on the Right, Where Excellent Negatives were Made—a Distance of 85 Yards

With a much more powerful ray than is commonly used in radiography these experiments proved that negatives could be taken at hundreds of yards' range. The long-distance radiographic experiments were carried out in two buildings, one on either side of a city square, with a distance of 85 yd. between them. This space was traversed by the X-rays, and the result was negatives from which good prints were made of a skull, a bottle, a crab shell, and other objects. This extremely long-range X-ray photography has been called "teleradiography." As already stated, the object of these experiments is to show just how far X-rays of given intensity, and under varying conditions, will penetrate, and to indicate what precautions are necessary to render them innocuous. The results are expected to contribute to the elimination of the risks now taken by X-ray operators.

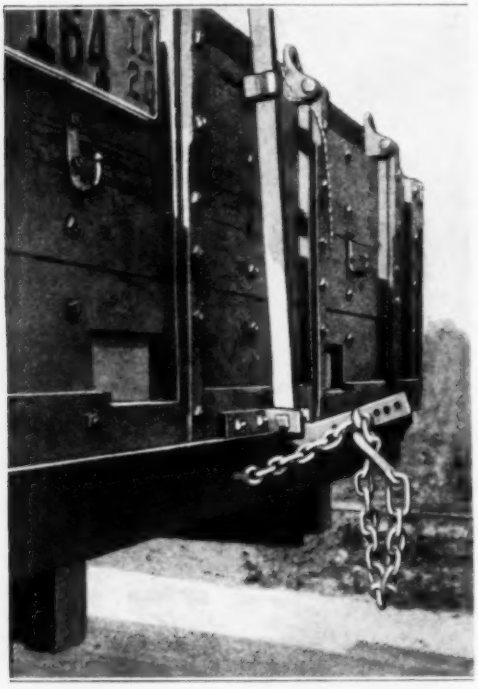
"Teleradiographs" Taken at 85 Yards: A Human Skull, the Shell of a Crab, and a Bottle Containing a Solution of Sulphate of Copper, Showing Results Equal to X-Ray Photographs Taken Close to the X-Ray Tube



Above: Plan Showing One Test of X-Ray Penetrability. At the Bottom Is a Sensitized Plate with One-Inch Steel Rod above It; Below, the 12-Inch Floor on Which Is a Frame Carrying on Top a Sheet of Lead and Below, a Marble Slab. The X-Ray Tube Is Directly Above, Six Feet from the Plate. The Result is Shown at the Left

LEVER ARRANGEMENT ON TRUCK DUMPS ROAD GRAVEL EVENLY

Roadbuilders of Iowa spread gravel evenly on the road by means of a simple lever arrangement attached to the hinged



Unhooking and Lowering the Top of the Lever Throws a Slack in the Chain, Which is Immediately Taken Up by the Opening Door. Fastening the Lever in Any Position Allows an Even Bed of Gravel to Flow Out upon the Road

door of dump-body trucks. The lever is bent at right angles a little below the fulcrum, at which point it is attached to the lower or opening end of the door. A chain fastened to the body sill of the truck is attached to the short, bent end of the lever through one of a series of holes. Lowering the lever, normally hooked at the top and chained at the bottom when the door is closed, allows the door to open by taking up the slack in the chain. The door may be set in any position by varying the length of the chain and hooking the upper end of the lever.

BATS AID DEVELOPMENT OF AVIATION INSTRUMENTS

Scientists have discovered how bats avoid objects they cannot see while flying, and are applying the principle to aviation in an attempt to protect air craft from collisions. Bats were blindfolded and released in a room divided by a grid, the openings in which were just large enough for a bat to fly through. The bats flew through the grid without difficulty. It was found that they emit a note, often inaudible to the human ear, which rebounds from objects and locates them accurately by the direction of the sound. Instruments which are expected to do the same thing for airmen are being perfected by British experts, and the progress already made convinces them that the instruments will be a success.

NEW MACHINE FOR SEALING MINIATURE TIPLESS LAMPS

A new miniature tipless-lamp sealing or splicing machine has been recently developed in New Jersey. The lamp to be sealed is held vertically in the machine by placing the bulb in a chuck provided with spring clips, the tube of the lamp being inserted in a jaw on the machine above the sealing point. Below this is the revolving head, which is rotated at from 100 to 125 r.p.m., and below this again is a handle, by means of which the lamp is moved up and down past the fires from the burners installed on either side of it. There is an automatic gas shut-off, and a clutch for stopping and starting the

New Sealing or Splicing Machine for Miniature Tipless Lamps, One Being on the Machine in Position for Sealing: Beside the Machine Are Several Samples of the Lamps Sealed

machine. The operator can produce from 150 to 200 lamps an hour.

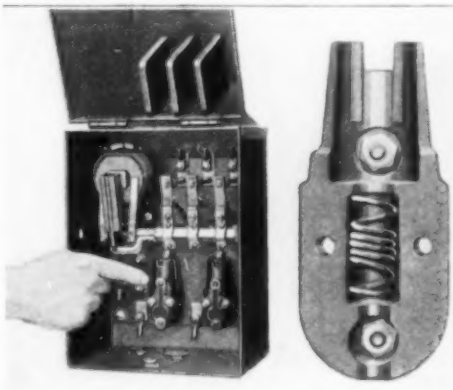
These Motorists can Watch Their Cars While Dining in This Open-Air Room. The Cars Stand in the Clearing before the Open Side. The Open-Air Restaurant Is a Summer Possibility in Any Temperate or Tropical Climate

AUTOS KEEP OWNERS COMPANY AT OPEN-AIR RESTAURANT

A new type of open-air restaurant which has parking room inside the restaurant property for the cars of the patrons, is becoming popular in California. Pergolas, built convenient to the roadway and thatched to keep off the hot California sunshine, serve as the dining room, and caterers bring the food ordered to the sheltered car. Another type of dining room where the car is invited, is characterized by a long thatched patio. It is open on one side, and the owner can drive his car to a point convenient to his table and watch it during his meal.

MERCURY OVERLOAD RELAYS PROTECT SMALL MOTOR

The wider application of small squirrel-cage motors is developed through the use of an automatic starter carrying relays that will protect the motor against dangerous overloading, while permitting momentary ones and supplying a generous starting current. A glass-inclosed mercury column is partly surrounded by a coil, connected in series to the motor, and so is heated to the same temperature as the motor windings. When the coil becomes too hot, the mercury is vaporized, and the motor is disconnected from the supply line by the deënergizing of a magnet coil. The period necessary for the mercury to vaporize guards against a tripping of the starter due to a momentary overheating. When the elements cool down, the motor is again connected.



The Hand in the Picture at the Left Points to the Mercury Overload Relay in the Starter Box. Right: Close-Up of Relay with Mercury Column and Coil

¶During the year 1920, a total of 18,671 machine flights were made in the work of civil-government flying under the direction of the Canadian Air Board. The aggregate distance covered by the machine was 33,612 miles. The only mishaps that occurred were three mild crashes with one person slightly injured.

Huge Mass of Logs Coming down Priest River, in Idaho, with the Spring Freshet: At This Point They Broke through a Heavy Boom That had been Built across the River by the Local Lumber Companies to Prevent Logs Destined for Their Mills from Going Farther down the River

SPRING HOLDS RADIATOR HOOD OPEN

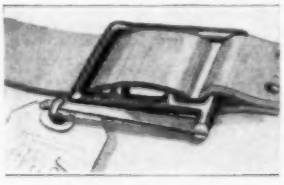
A little spring-steel article enables the automobile to be driven with the hood slightly raised. The holder is firmly attached to the car frame, directly below the hood handle, by a bend at the bottom which grips the angle iron. When the hood is down, the spring is behind it, holding tightly outward to prevent rattling.

RAGING STREAM CARRIES LOGS THROUGH BIG STOPPAGE BOOM

In the heart of a great lumbering district in northern Idaho, at Priest River, near its crossing by the Great Northern Railroad, a number of companies located in the vicinity combined to build a boom across the river with the object of preventing their logs from being carried past their mills down the river at times of high water. Last spring there was an exceptionally big jam of logs above this point, previous to the arrival of the freshet which also was exceptionally high. The combination was irresistible, and although the boom held for a time, finally it yielded to the pressure of what was estimated to be equal to 20,000,000 ft. of timber. Fortunately, besides the boom, some big jam piers had been erected in the river, and if it had not been for these, all of the logs would have been carried away by the raging stream, whereas, as a matter of fact, only about a third of them were lost.

BUCKLE OF PARCEL STRAP HAS TAG-ATTACHING CLIP

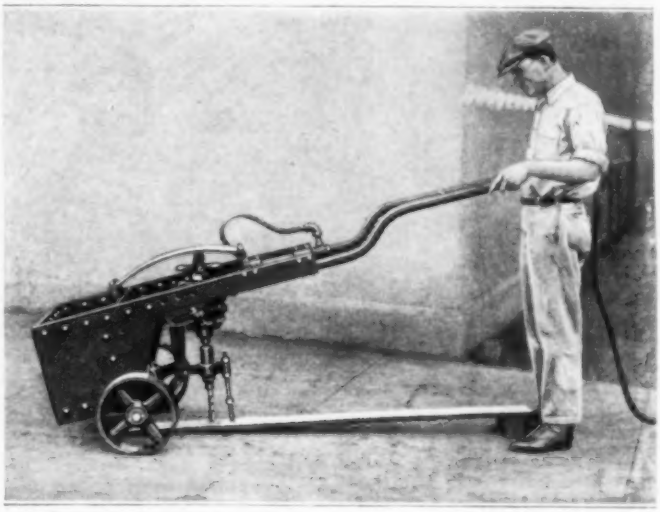
A buckle which engages a strap tightly about a parcel, is designed with a clip attachment on one side to hold a standard shipping tag. The tag can be removed or replaced by pressing down on a steel spring, which holds it in place flat against the package and prevents its being torn or mutilated. The strap and clip buckle do away with the use of string, and produce a neater package.



¶ The Bureau of Mines predicts a field of usefulness for slate waste as an asphalt filler instead of cement or limestone.

PORTABLE DRILLING MACHINE IS ADJUSTABLE TO WORK

A motor-driven drill for use about shipyards and industrial works where structural steel is frequently drilled, consists of a drill unit supported in a metal frame, which is provided with two wheels and handles for transportation to the work. A special feature of the device is the means of maintaining the drill vertical to the piece being worked. This arrangement consists of an outer post which is adjustable for height by means of a threaded sleeve and nut. The drill runs through a collar which is perpendicular to this post, and since the latter has been previously adjusted, the drill is kept in vertical alinement. The drill works against pressure exerted downwardly on the handles, and by means of springs is brought up out of the work after the operation has been completed. Provision is made for weighting down the rear of the machine to steady it.



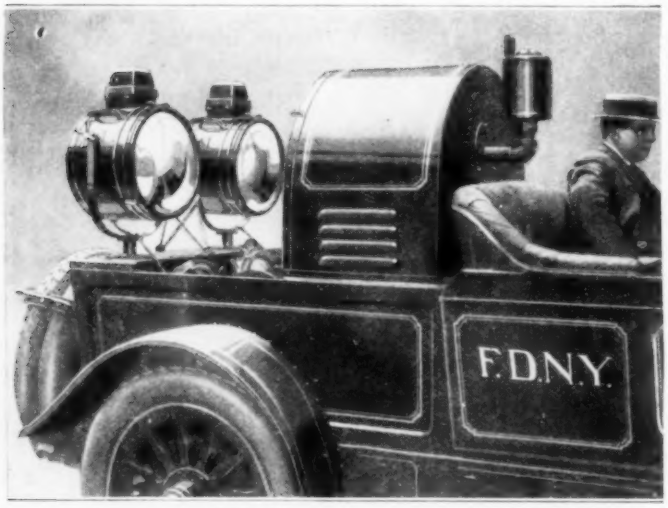
This Portable Drill Gets Pressure for Cutting by the Operator Bearing Down on the Handle. The Drill is Kept Vertical by Means of an Outer Post Which Is Parallel to It

HEAVY ICE FORMS STRANGE DRYDOCK

A British ship in trying to negotiate the White Sea near the Solovetsky Islands, at a time when the inlet is always in danger of freezing over, got fast in the ice and was frozen in solidly. There was something wrong with the ship's propeller, and the captain came to the conclusion that this was as good a drydock as could be found, and after a few more days of freezing, the ice was chopped away around the propeller until it was free, and using the winches of the ship, it was removed and transported, with considerable labor, to one of the islands, where the necessary repairs were made in the forge shop of Solovetsky monastery. The ship was not free from the ice until three months later, but when it did loosen it was ready with a perfect propeller to make its difficult way through ice floes northward, and it returned to England without further misadventure, and in good condition.

Propeller of the British Ship That was Caught in an Ice Pack Near the Solovetsky Islands, in the White Sea, and Satisfactorily Repaired in this Unusual "Drydock": The Ship Was Ice-Locked for Three Months

HIGH-POWER SEARCHLIGHTS AID FIRE FIGHTERS



The Generator, Just Behind the Driver's Seat, Supplies the Power for the Two Large 5,000-Candlepower Searchlights Mounted in the Rear, and for the Five 1,000-Candlepower Portable Lights in the Truck, Used for Fighting Fires Both Inside and Outside of Buildings

Searchlights, penetrating the thick clouds of smoke, will now illuminate both the interior and exterior of buildings for the benefit of the fire fighters. The New York Fire Department has received a gift of a truck equipped with two 5,000-cp. searchlights and five 1,000-cp. portable lights, together with a gasoline-driven 3-kw. generator, capable of supplying all the energy necessary for operation. The portable lights can be carried into a burning building for exploration of the interior. When first tried, the lights illuminated a building which is 375½ ft. high.

BRIDGE TO CONNECT NORFOLK AND PORTSMOUTH

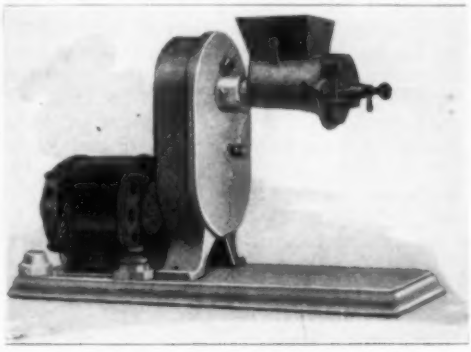
A proposed high-level bridge, between the cities of Norfolk and Portsmouth, Va., will have a clear span of 1,850 ft. between tower centers, and a headway clearance of 150 ft. above mean tide level. This allows the passage, under the main span, of the largest ocean-going ships, and leaves communication free between the inner harbor and the navy yard farther up the river. The proposed span is greater than

Proposed Suspension Bridge to Connect Norfolk and Portsmouth, Virginia, with a Main Span of 1,850 Feet between Ocean-Going Vessels: The Approaches are Only Partially Shown. The Bridge is to Be of the Su

that of any of the bridges at New York, and is 100 ft. longer than the span of the famous Forth Bridge in Scotland, which for so long held the record as the largest span in the world. The bridge is to be of the suspension type, similar to the well-known Brooklyn Bridge. The estimated cost of this great enterprise is 20,000,000 dollars.

MOTOR-DRIVEN GRINDING MILL USEFUL FOR MANY PURPOSES

An electric grinding mill, which can be used either for the home or the laboratory, is readily converted into a mixing chamber for the chemist. The grinder, and the motor which operates it, are mounted on a heavy base so as to eliminate all vibrations. An interesting feature is the interchangeable grinding unit. Poisons for the chemist and foodstuffs for the home, may be ground in the same mill by the use of separate grinding units,



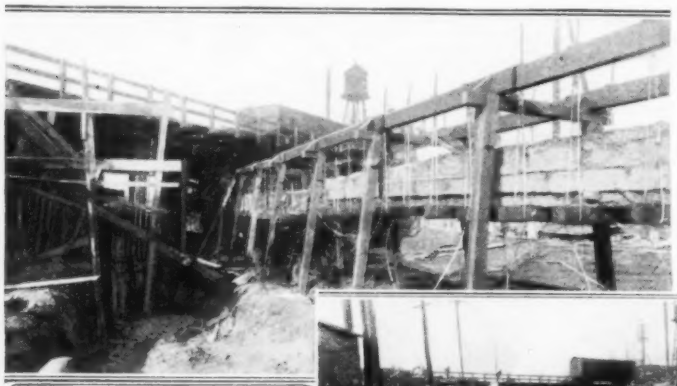
This Mill, Equipped with Interchangeable Grinding Units, is Built Heavy to Eliminate Vibrations

which differ in construction according to the purposes for which they are needed.

the Tower Centers and a Headway Clearance of 150 Feet above Mean Tide Level, Allowing the Passage of the Largest pension Type, Similar to the Well-Known Bridge That Connects Brooklyn with New York City

CONTINUING POWER SERVICE WHILE MOVING CABLES

When recently a section of railroad was to be lowered 12 ft. to eliminate a grade crossing in Minneapolis, the company supplying light and power to that city was confronted with a problem of either lowering two underground ducts, which ran under the track at this point, a like distance for a length of 1,100 ft., or of temporarily discontinuing service and rerouting the cables. To maintain continuous service a system of suspension lowering was decided upon. After excavating both sides of the street to the required level, the ground under the tubes was cut away at 10-ft. intervals, leaving intermittent supports of dirt. In the openings were erected trestles of crossties and uprights, with planks nailed lengthwise along the tops. Short crossties, 2½ ft. apart, were slipped under the cable tubes and loops of guy wire suspended from eyebolts in the trestle planks and passed about the ends of these crosspieces. The eyebolts were then adjusted to take up weight and the remaining dirt cleared away. In lowering the lines the eyebolt nuts were loosened in alternate pairs until the ends of the bolts had been reached, whereupon the guy wires were alternately lengthened and the eyebolts backed up for a new drop. This process was continued until the new level had been reached, when the forms were taken down and removed.



A Large Minneapolis Conduit Duct was Lowered 12 Feet to Meet New Grade Requirements. Above: The Duct in a Suspension Construction of Slings and Ties. Below: Lowered to Its New Level and Ready for the Covering Process

The Duct being Lowered: Turning of the Eyebolts Which Held the Cable Slings, and Alternately Changing the Latter, Accomplished a Successful Landing

Although intended primarily for the purpose of continuing power service during the transfer period, the final cost of doing the work by this method was found to be 40 per cent less than that of a similar job at another crossing, where the cables were temporarily rerouted and the old lines dug out and rebuilt.

¶ Christmas-tree light sets, which were formerly obtainable in series of 16, 24, and 32 lights to the unit, may now be had in single units of eight lights that may be added to one another to make the higher multiples. Plugs and sockets are provided in the sets of eight to facilitate connection. For extra-bright lights standard bulbs may be inserted in the end sockets.

PULVERIZED COTTON AND WOOL USED IN MANY INDUSTRIES

It is difficult to imagine cotton and wool in the form of a fine powder exactly similar to wood flour which is largely used in industry. Nevertheless, it is announced from France that already five or six factories there are engaged in the industry of pulverizing cotton and wool for several quite diverse applications.

Very finely powdered cotton is used as a filtering material for clarifying certain solutions that are difficult to filter, such as collodion. It is used in the manufacture of phonograph records, making them less brittle, and having the more important property of suppressing secondary vibrations which cause an objectionable twang. It is also incorporated in bakelite instead of wood flour. Mixed with the material used in the manufacture of insulators, it has the effect of making that material less brittle and improves its insulating qualities. It is also used to produce various decorative effects in household furnishings, and in different kinds of fabrics. Besides the uses to which it has already been applied, there are many other branches of industry in which it will be of value.

CITY-BEAUTIFUL MOVEMENT AIDS CITY BOOSTING

To encourage civic art and to oppose influences which hinder the city-beautiful movement, the Municipal Art League of Chicago has prepared a series of postcard views of Chicago and vicinity. The new cards are made from prize-winning pictures in a recent photographic contest and are finished in the finest photogravure work. They are an absolute departure from the idea of the ordinary picture postcard, and are expected to add to the prestige of the city by a truer and more satisfactory expression of its beauty.

SPECIALLY BUILT VALISE FITS FRONT OF SIDECAR

The nose of the motorcycle sidecar is used by an English inventor as a storage space for luggage. A specially constructed traveling case, shaped so as to fit the upper part of the nose, is strapped in a compartment formed by swinging that part of the car forward on hinges. The case carries an assortment of articles necessary for a journey, and can be readily removed or replaced in the compartment. The car is also fitted to carry luggage in pockets along the sides and in a compartment behind the seat. Altogether quite a bit of luggage is carried without marring the lines of the machine or inconveniencing the passenger.

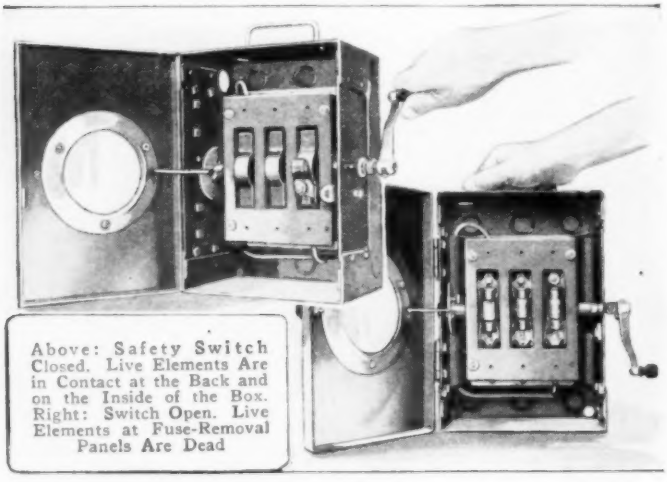
Lady Placing Specially Shaped Valise in the Compartment that Hinges on the Nose of the Sidecar
Above: Upper Part of Hinged Nose Raised, with Its Top Open Showing Specially Shaped Valise in Its Compartment

Motorcycle Sidecar with Hinged Nose Containing Storage Space for a Valise: When Lowered to Position the Hinged Nose is Secured by Catches. In the Car Rear Is a Pocket for Other Luggage

A reopening of the world-famous Silver Islet silver mine, which for forty years has been flooded, is contemplated soon. The mine is located near Fort William, Ont., and was once reputed to be the richest in the world.

NEW ELECTRIC SWITCH IS BUILT FOOL-PROOF

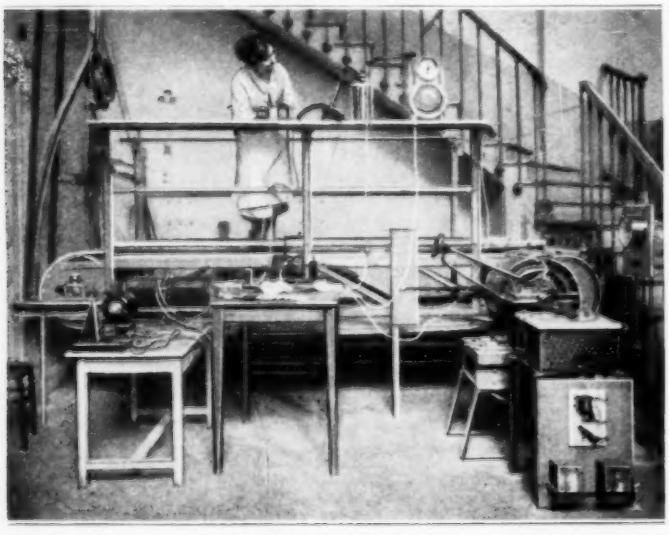
An electric switch of late design is built so that even the most unfamiliar workman could not be hurt, were he required to operate it. In principle, the switch is rotary. The fuse and contact elements are placed over a square shaft which terminates at the operating handle. When the handle is turned to the working side, the live elements make contact on the inside and at the back of the box. Meanwhile only heavy insulators appear at three fuse-removal panels in the front. To shut off the current, the handle is turned to the opposite center, exposing the fuse and contact elements at the panels. In this position, they are harmless, as they are out of contact at both sides. A shunt appliance on the fuse terminal prevents overloads at the moment of breaking the current.



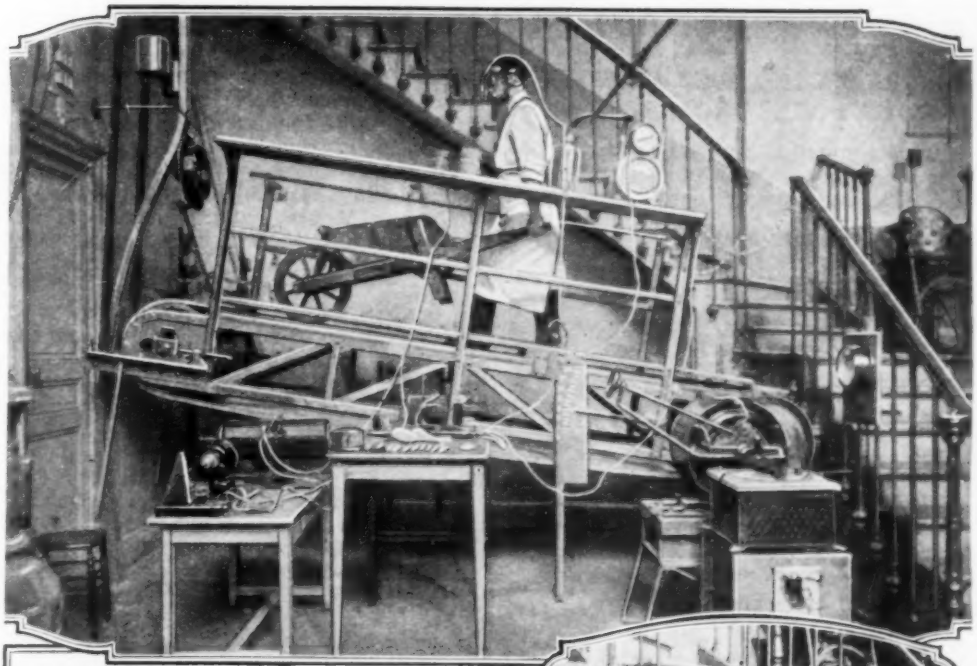
Above: Safety Switch Closed. Live Elements Are in Contact at the Back and on the Inside of the Box. Right: Switch Open. Live Elements at Fuse-Removal Panels Are Dead

DEVICE FOR STUDY OF HUMAN BODY IN ACTION

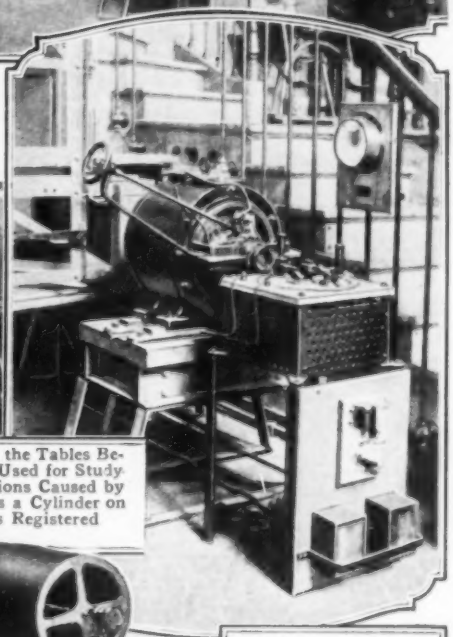
Many important results can be obtained by a biological study of the human body when in action. Hitherto this study has been possible only when the body was undergoing moderate exercise, but now a French professor has designed a machine and equipped it with instruments by means of which the body of a man or woman undergoing the most violent forms of exertion may be fully studied as regards the physiological effects of this exertion. The essential part of the machine is a platform with a movable floor in the form of an endless belt, driven by a motor. This platform can be set horizontally or on slopes up to 25°. It is possible to study the human body in action on this platform in a manner equivalent to a running speed of 18 miles an hour, as well as during the performance of heavy labor, such as carrying weights or pushing a wheelbarrow. Instruments for measuring temperature, blood pressure, and physiological reactions, are arranged on tables below the platform, and are connected by means of rubber tubes with the various parts of the body of the person under examination.



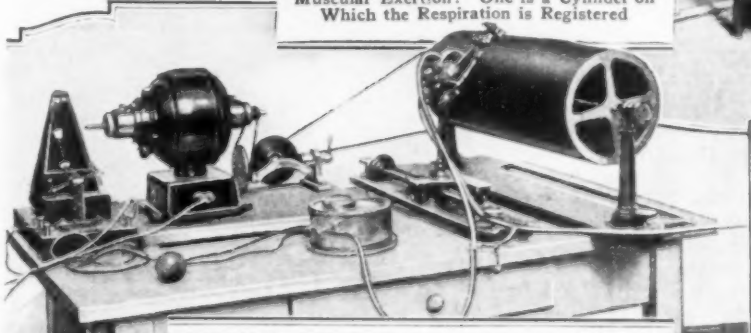
Platform with Registering Instruments on Tables beside It, Devised by a French Medical Professor for the Study of the Human Body When in Action: The Platform is Shown in Its Horizontal Position



Platform for the Study of the Effects of Exertion upon the Human Body, Shown with a Man Undergoing Tests, While Doing Work Equivalent to Pushing a Wheelbarrow up a Hill: The Tubes from the Man to the Instruments Below Cause Them to Register Physical Effects of This Exertion



Some of the Instruments on the Tables Below the Platform, That are Used for Studying the Physiological Reactions Caused by Muscular Exertion: One is a Cylinder on Which the Respiration is Registered

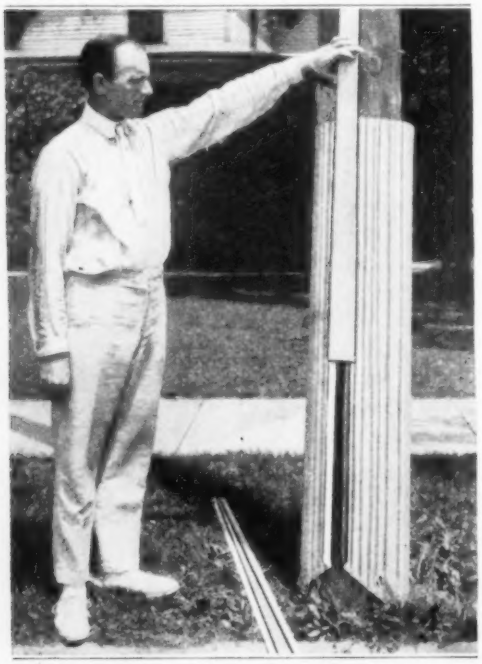


Some More of the Instruments That are Used for Measuring Temperature, Blood Pressure, and Physical Reactions Resulting from the Exertions of a Person Doing Various Kinds of Work on the Movable Platform

Electric Motor Which Drives the Movable Floor of the Platform: This Floor Is in the Form of an Endless Belt Running over Two Pulleys, One at Either End of the Platform. The Speed of the Belt can be Regulated

SHEET-METAL SLEEVE SAVES PHONE POLES FROM ROTTING

Many appliances for the protection of telephone and telegraph poles against rotting and subsequent destruction have



The Sheet-Metal Sleeve Fits around the Pole and is Held in Place by a Key Piece. It Protects the Pole from Rotting at the Ground Surface

been developed from time to time. The latest of these is a corrugated sheet-metal band or sleeve, which is heavily galvanized and cut down its length to fit around the post at and below the ground line. A key driven over the curled edges of the guard opening, draws it together in a tight fit about the pole. Pitch is then poured in at the top of the device to prevent leaking in of water.

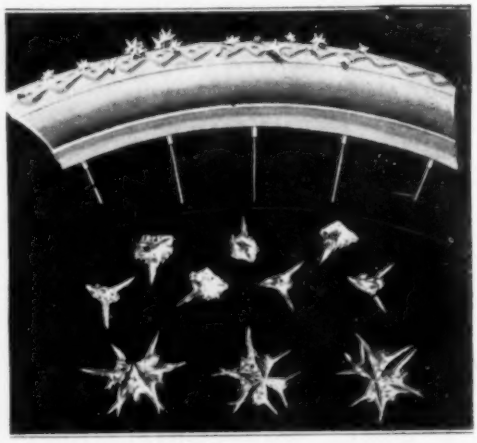
BALLOON MAKES CANOES FOR CANADIAN INDIANS

Those who live on the border of civilization are always on the lookout for some product of civilized government that they may appropriate for their uses. Recently a group of very fine lightweight canoes appeared in the James Bay region in Canada. The source of these was quite a mystery. No such canoes had been seen there before. And they were in the hands of a group of outlaw Indians who lived in a small village over sixty miles from Moose Factory and hundreds of miles from any place where they could get material suitable for making such canoes.

But finally some one solved the mystery. The great balloon that the United States naval balloonists had abandoned when it fell near Moose Factory had been destroyed. Orders had been issued from Moose Factory that it should not be touched, but the outlaw Indians were out of the jurisdiction of Moose Factory, and the temptation to use it for canoes was too strong.

PUNCTURE WEED IS NEW PEST FOR MOTORISTS

Motoring has its joys and its sorrows, and now comes a new score for the sorrow side of the sport in the form of an abundant weed which punctures tires. It is called by some the "devil bur," while others have named it the "puncture weed," and to the latter description it more truly answers. When mature, the bur splits into five sections, each of which is equipped with a pair of sharp spines, so disposed that one always points upward. They are supposed to have been introduced into this country from southern Europe, being brought here in the wool of thoroughbred sheep. Quickly taking a hold in California and Arizona, the pest soon cropped out in Arkansas, Texas, Kansas, Nebraska, Illinois, Indiana, and



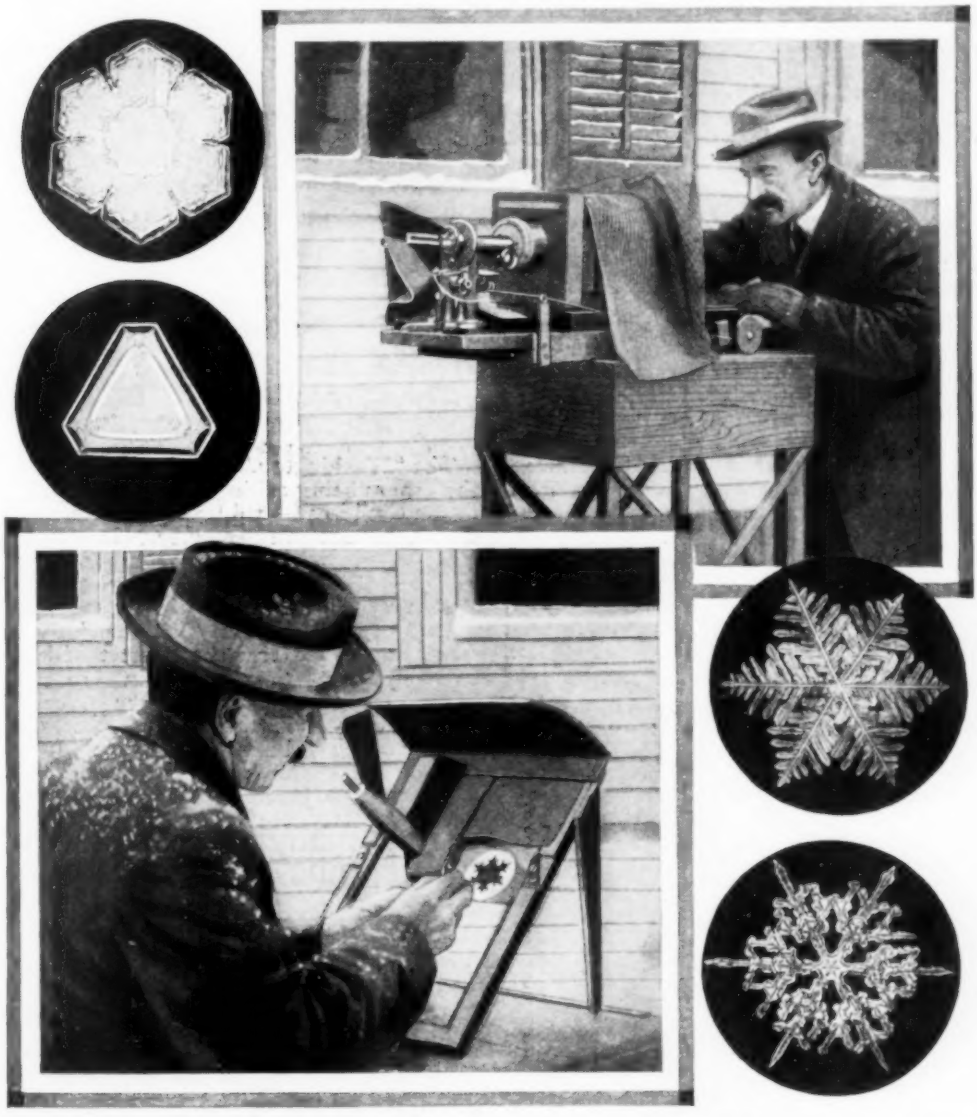
Puncture Weed Burs in a Tire: The Bur Sections are Shown below the Tire and the Mature Burs at the Bottom. There Are Two Spines in a Section

Iowa, until now it is a question of some concern as to how it can be stamped out. One motor car sustained 70 punctures over a course of 35 miles through infested territory.

FARMER-SCIENTIST PHOTOGRAPHS SNOWFLAKES

Scientific farming is an old story now, but it is not often that one hears of a farmer who is a scientist in other lines. W. A. Bentley, of Jericho, Vt., is a notable example of this exceptional type of farmer. He has spent 35 years of his life, occupying all the time he could spare during winter in the tedious task of photographing snowflakes.

Anyone who has ever seen how varied and beautiful are the reproductions of snowflakes enlarged, will understand that this farmer may have undertaken his labor as much out of love for art as love for science. His collection includes as many as 4,000 negatives, and no two are alike. This labor has all been done with a primitive photographic and miscroscopic



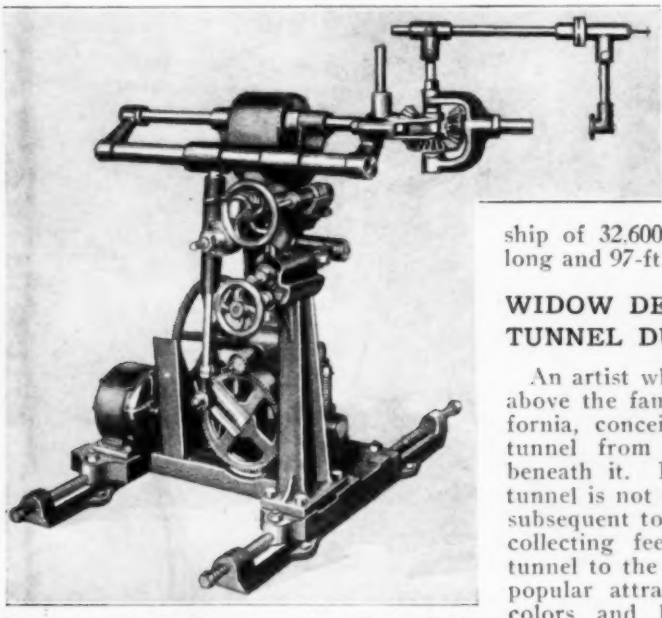
Upper Right: Preparing to Take a Photograph of a Snowflake with the Homemade Apparatus, Which Consists of an Old Camera Mounted on a Sliding Frame in Front of a Microscope. Lower Left: Removing the Film to Produce a Black Background. The Four Negatives Illustrate the Dainty Beauty and Regularity of Design Found in the Frozen Dewdrops and Flakes

apparatus that can be bought for only $90. He was the first man in the world to devise a means whereby such an evanescent, feathery, minute object as a snowflake could be photographed and enlarged with exactness with such simple equipment. The rigorous winters of his native state were, of course, in his favor. But, even in the intense cold of Vermont, great speed is required in this work, for, once a snowflake is isolated, although there may be no danger whatever of melting, it is subject to evaporation, a process that is just as destructive, in the case of such a fragile object as one flake of snow. And in spite of this extreme fragility, the one flake of snow has to be handled for the photographic process, and it has to be handled so gently, that even a feather is a heavy tool to have to do it with.

Mr. Bentley is now recognized as the world's authority on snowflakes, and much gratifying appreciation has been expressed to him from Australia, China, England, and other far-away places, as well as from the nearer haunts of American scientists. He has made the same kind of study of other water forms, such as frost, ice, dew, rain, and hail, but his first love was snowflakes, and, traditionally, it abides.

ARTICLES OF ANY CONTOUR FED TO BUFFING WHEEL

Holding an article of any contour, and slowly rotating it against a polishing or buffing wheel, is the function of a machine equipped for rotating, reciprocating, oscillating, sliding, angular, or a combination of any of these movements. Reciprocating motion is imparted by a sliding frame; oscillating motion, by means of trunnions supporting a vertical column carrying the sliding frame; sliding motion, by slide rails on which the bedplate rests, and angular, through a variable-angle attachment. The work is held against a rotating shaft by a free-moving wood disk on a spring-controlled arm. When run in pairs, two machines can be operated by one man, thus effecting a great saving in labor.



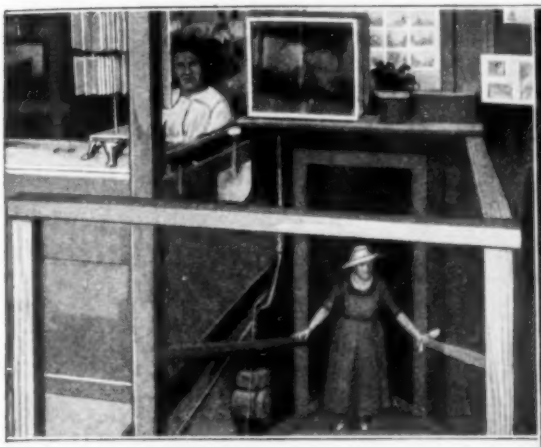
The Gap in the Spindle, at the Upper Right, Holds an Article of Any Contour, and Slowly Rotates It against a Buffing Wheel. The Holding Arm is Movable, Permitting Ease in Replacing Articles

THE "WASHINGTON" ONE OF FOUR NEW BATTLESHIPS

The "Washington," fourth of its name—the others being sailing vessels built prior to the Civil War—will leave its ways early in September. It is a sister ship of the "Maryland" and, together with the "Colorado" and "West Virginia," will form the quartet of battleships soon to be launched. The "Washington" is a 21-knot, oil-burning, electric-drive ship of 32,600 tons' displacement, 624 ft. long and 97-ft. beam.

WIDOW DERIVES INCOME FROM TUNNEL DUG BY HER HUSBAND

An artist who once lived on the heights above the famous La Jolla cave in California, conceived the idea of digging a tunnel from his house to the grotto beneath it. His motive in building the tunnel is not clearly defined, but in years subsequent to his death his widow began collecting fees for a trip through the tunnel to the cave. The grotto is a very popular attraction because of its many colors and beautiful rock formations. Each tide floods it and stains it with new and wonderful tints. Four years were required to build the tunnel, and stubbornly the artist labored against the resistant sandstone and hard clay, until the 172-ft. shaft was completed. The front room of what was the cottage home



A Little Curio Shop Stands at the Entrance to the 172-Foot Shaft Leading to the La Jolla, California, Caves. The Shaft was Chiseled by an Artist from His Home on the Cliff Above. Right: A Scene in the Beautiful La Jolla Caves with Tourists Descending toward the Water

of the artist is changed into a curio shop. Revenues gained in charges for trips through the tunnel to the cave, sale of curios, and royalties paid by motion-picture concerns for the use of the grotto, net the widow a substantial yearly income.

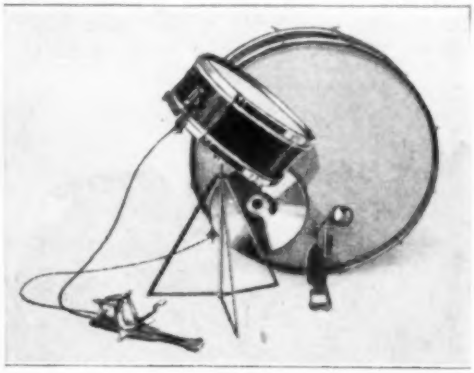
NEW ORLEANS MAY HAVE NATURAL GAS SOON

One outcome of the old controversy between the controllers of artificial gas and the people of New Orleans, La., which, it seems, will lead to some constructive good, is the consideration of natural-gas possibilities in that city. While others have wrangled over the artificial-gas case, one Monroe oil-field interest has had an engineering survey and a cost estimate made for the piping of the natural product to the delta city. Crossing the Mississippi River is one of the obstacles to be overcome and such a crossing is proposed at Natchez, Miss. Special insulation is necessary on the pipes, which will be twin 18-in. tubes, for protection against destructive chemical actions in the swamp lands of Louisiana. The installation cost is estimated at $15,000,000 and the time for construction, at approximately 18 months.

¶Special platforms for use in changing wheels and brasses on the trucks are built at the girder ends of electric traveling cranes in a large Chicago steel concern as a safety measure. They eliminate the necessity of many unsafe practices.

PEDAL OPERATES DRUM SNARES AND CYMBALS

Not satisfied with the quantity of "jazz" in the modern syncopated orchestra, a pedal that will operate the snares on the snare drum and the cymbals on the bass drum, two of the best producers of the shaky movement, has been invented. The pedals, which can be worked singly or

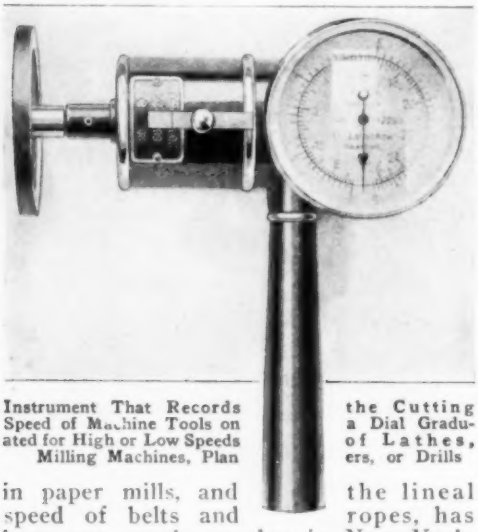


The Device Shown at the Left of the Snare Drum Contains Two Pedals, One for Operating the Cymbals, and the Other for Rattling the Drum Snares

together, are operated by the pressure of the left foot. One of the pedals releases the snares while the other operates the cymbal. The bass drum is operated by a right-foot pedal, as usual, leaving both hands of the drummer for the other sweet-music producing instruments.

MACHINE-TOOL CUTTING SPEED SHOWN BY NEW INSTRUMENT

An instrument for measuring the cutting speed of machine tools of all types, and that will also record the speed of rolls



Instrument That Records the Cutting Speed of Machine Tools on a Dial Graduated for High or Low Speeds of Lathes, Milling Machines, Planers, or Drills

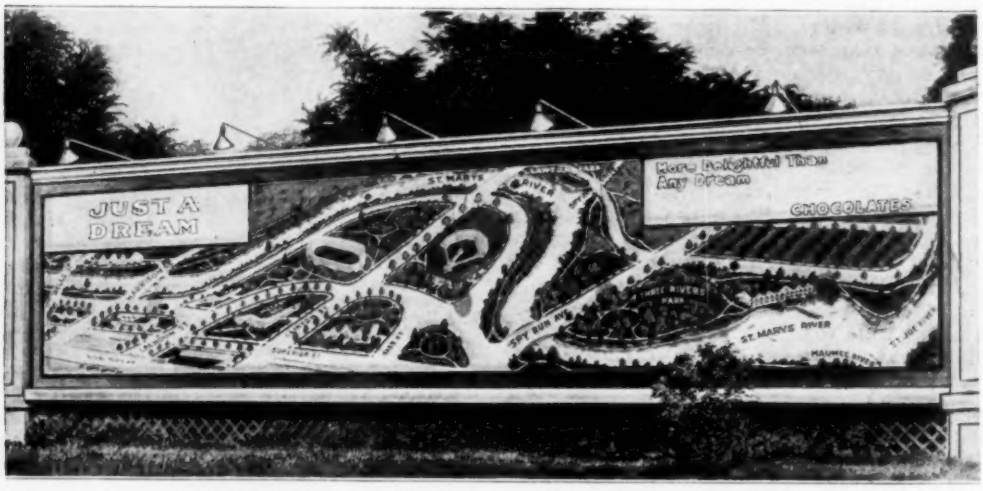
in paper mills, and the lineal speed of belts and ropes, has been put on the market in New York. The instrument gives direct readings, without any timing or calculating, on a dial, which is graduated to record all high or low cutting speeds of lathes, milling machines, planers, and drills. In operation, the instrument is held by a handle so that a friction wheel at right angles to the handle is pressed against the object whose motion is to be measured, and the dial, which is at the end of the handle, faces the operator. The friction wheel can be replaced by a pointer, such as is used on all tachometers, and the instrument then records revolutions per minute.

PLANES FIND SHORT ROUTE FROM CAIRO TO BAGDAD

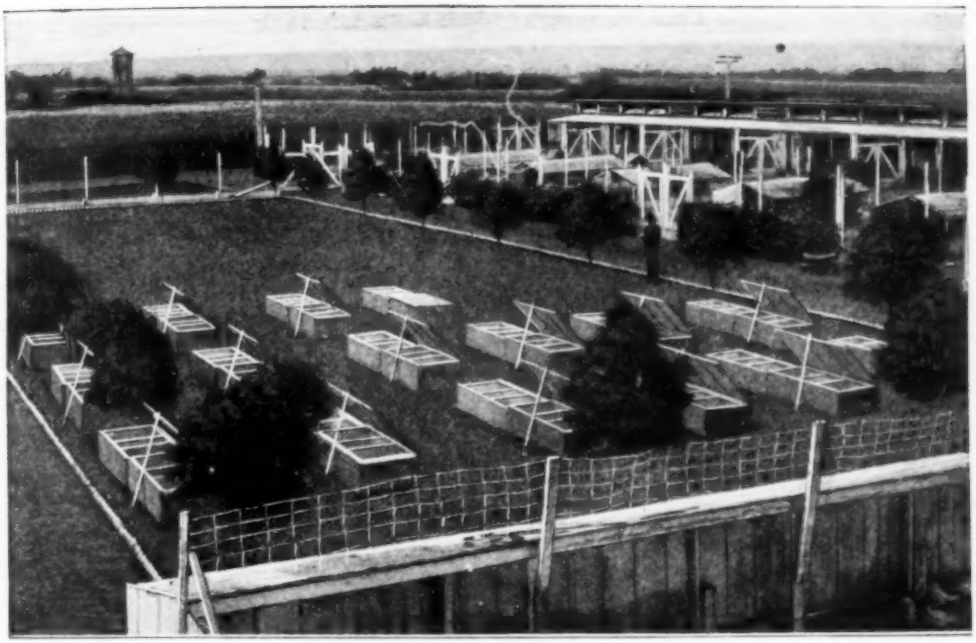
The distance from Cairo, Egypt, to Bagdad, Mesopotamia, has practically been halved for the overland traveler by recent aeroplane discoveries in that land. Lava beds that have hitherto been impassable may now be crossed successfully over a pass found by the airmen. This is very important in that it brings the two eastern cities about 600 miles closer by wagon road. The planes received the hearty coöperation of the authorities and were also accompanied by a caravan of wireless-equipped desert tenders and armored cars for marking the newly discovered route.

BIG SIGN PICTURES SUGGEST CIVIC IMPROVEMENT

Seldom do outdoor signs merit the approval of esthetic citizens. A novel advertising idea of a candy manufacturer at Fort Wayne, Ind., has drawn the commendations of the progressive inhabitants. It pictures a suggested development of some waste land near the heart of the city. The design is complete as to park arrangements, athletic fields, and other features of a civic center and recreation grounds.



This Sign Is Somewhat Different from the Usual Type That Lines Highways and Vacant City Lots. It Advertises Chocolates, but Draws the Attention of the People of Fort Wayne, Indiana, by Visualizing a Possible Civic Improvement



Brood Pens on the Grounds of the Washington State Penitentiary: Silver and Chinese Pheasants are Propagated Here for Subsequent Distribution throughout the Counties of the State

WORLD'S ONLY CONVICT-OPERATED GAME FARM

By LAWRENCE WILLIAM PEDROSE

EXPIATION of their crimes by rehabilitating wild-game life of the forests and fields of Washington State is the self-appointed task of the prisoners in Walla Walla penitentiary on the world's only convict-operated wild-game farm.

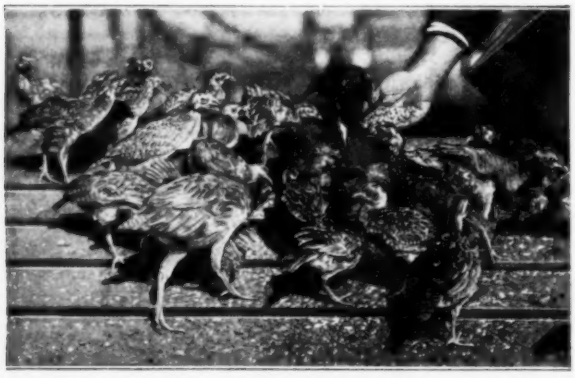
Three years ago, an arid tract of land, studded with wiry sagebrush, stretched dismally before the forbidding walls of the penitentiary. Today, more than 40 acres of this expanse is a flower-decked green field which shelters thousands of game birds—a miracle which found its materialization through the tireless efforts of society's outcasts, men who, as far as the world knows, have lost their names and are designated only by numerals. These men are long-termers who have become trusties through good behavior. The trusties must sleep behind the bars of the prison, but their entire days are spent on the game farm. No walls or formidable fences surround them, and avenues of escape are open in many directions, but they are satisfied with the freedom allowed them, their work is engrossing and constructive, and they do not attempt to get away.

The Man in the Center Is a Practical Game Breeder Supervising the Prisoners in Game Propagation at the Walla Walla Prison. They are Counting One Day's Egg Collection

The farm, the land, and its bird population are state-prison property, but the output of the institution, thousands of game birds every season, belongs to the people of the state, the sportsmen who hunt in valley and on upland when the season is open.

In the spring and summer, activity on this game farm is at its height. Scores of motherly hens, varying in size and type from bantams to plymouth rocks, are sitting on nests filled with pheasant eggs. Several hatchings oc-

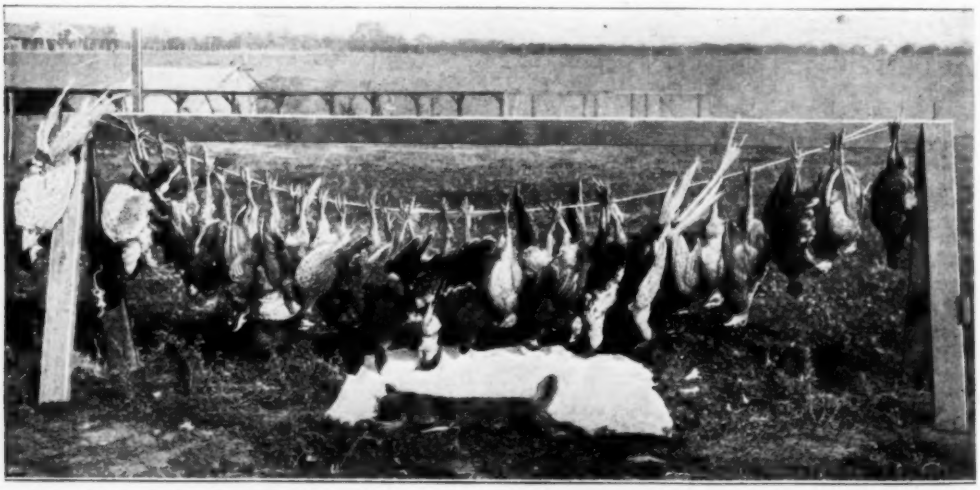
cur daily, with scores of pheasant chicks pecking their way into the world in blissful ignorance of their environment of domesticity and their foster mothers. Following hatching, the broods are consigned to the alfalfa field, where the chicks grow rapidly. When they get their growth, the wild instinct comes to them, so, to prevent their flying away, they are put into inclosed pens, where they are kept as breeding stock, or held for liberation later in the woods and fields of the various counties of the big state. The convict caretakers have much work to do, and their efforts are directed by two practical game breeders. Their labor consists in preparing morning and evening mashes for the chicks and adult pheasants, feeding the birds, locking them up at night, keeping them free from vermin, protecting them from predatory animals, and taking care of the eggs. Gathering the eggs is, perhaps, the most exacting task, for they must be picked up almost as soon as they are laid, because one of the most perplexing traits of the pheasant hen in captivity is that she eats her own eggs.



These Young Pheasants were Hatched under a Hen. They Soon Get Quite Wild, and Penning Is Necessary to Keep Them from Flying Away

There are, in addition, more than 300 Chinese pheasants, popularly known to sportsmen as "Chinks," on the farm. They yield from 1,000 to 1,500 eggs each week. In addition, Mongolian, Reeves, golden, and silver pheasants are propagated, but on a smaller scale. Ten thousand Chinese pheasants will be hatched out on the farm this season. From these, it is estimated, between 5,000 and 7,000 mature pheasants will be delivered to counties in the state for liberation in the fall. Besides

Chinese Pheasant Eggs: The Chinese or "Chink" Pheasant Is a Prolific Layer in Season. Thousands of Their Eggs are Distributed throughout the State

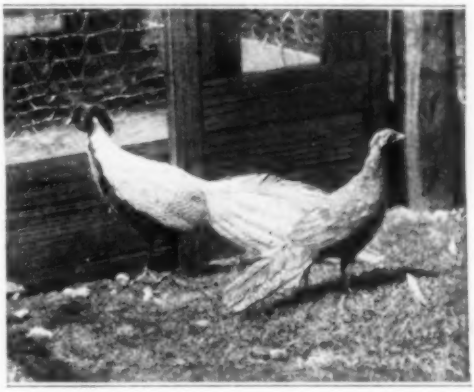


Predatory Animals Are the Pheasant's Worst Enemies. This Cat Murdered 30 Good Breeding Pheasants Before It was Killed. Ferrets are Kept at the Farm to Catch Snakes and Ground Animals

the fowl, about 7,000 Chink eggs will be distributed to various counties, to be hatched out through the agency of the county commissioners and volunteer breeders, such as sportsmen's associations.

This year, for the first time, the propagation of mallard ducks has been projected, and between 300 and 400 mallard ducks will be liberated this season. Experiments are being made with wild Canadian geese, peacocks, Hungarian pheasants, and lesser varieties of game birds, and these probably will be raised in considerable numbers next year.

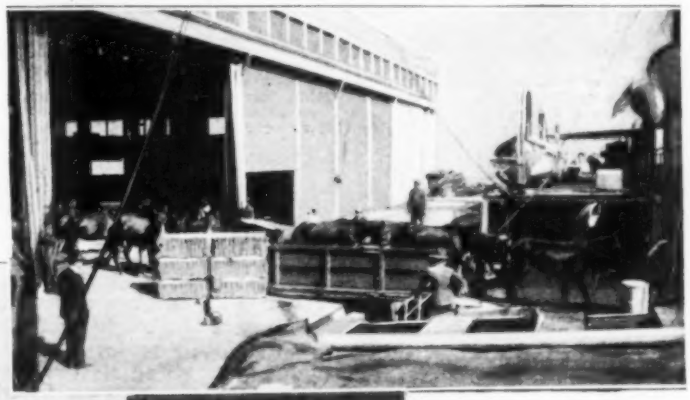
Means of protecting the propagated game have been developed. Along the wire fences which skirt the farm, clever traps for hawks and other predatory birds are placed. Ferrets are used to destroy rats, snakes, etc., in the ground. Ducks have the natural protection of secluded pools. As an illustration of the hazards of raising wild game birds, a stray cat in one night killed 30 pheasants of various kinds before it was shot.



Silver-Pheasant Cock and Hen for Propagation: The Convicts of the Prison are Very Much Interested in Breeding These Game Birds

MULES TRAVEL TO HAWAII IN KNOCKDOWN STALLS

Hundreds of American mules are carried on steamships operating between San Francisco and Hawaii without any loss of space for ordinary cargo. Knockdown stalls make this economy possible. As soon as the vessel touches the Frisco pier, prepared timbers are hauled out of the hold, assembled, and bolted to the deck. Extending along the port and starboard rails, the structures take the form of corridors, sheltered on the outboard side, but with only feed boxes along the inside. When the falling tide lowers the deck to the level of the pier, the mules are driven aboard. The first mule passes down the long stable to the farthest end. Here the animal is confined by a partition which is slipped into place. The second mule is then admitted, and so on. The stables are knocked apart, and loaded into the hold for the return trip.



Driving Mules from the Dock to the Boat Bound for Hawaii

Knockdown Mule Stables aboard a Ship Bound for Hawaii from San Francisco: The Temporary Stables Are Great Space Savers

GROTESQUE CEMENT FIGURES ORNAMENT COUNTRY ESTATE

A Denver sculptor has decorated a lily pond and the roads of his country home by the use of clownish-faced heads in various expressions of mirth and grief. The heads, cast in painted cement, are placed on short bases in the lily pond, and on pedestals at the side of the roads, and have each a small water pipe throwing water in different directions from various points, which adds a startling touch to the figures. Two tiny streams of water trickle down the cheeks of one of the figures lining the road, the face having assumed an expression of extreme grief.

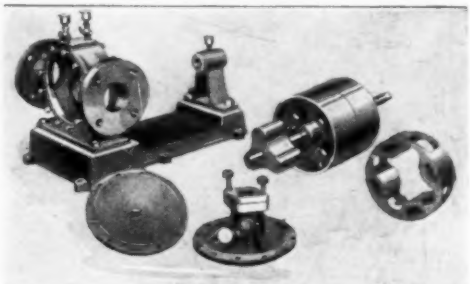
These Three Winking Faces, Emerging from the Water, Lend a Merry Touch to a Country-Estate Lily Pond. The Streams of Water Issuing from the Mouths, in a Form Suggestive of Play, are Caused by Tiny Water Pipes Throwing the Water Out under Pressure

FRENCH FIRM PLANS GIANT PASSENGER MONOPLANE

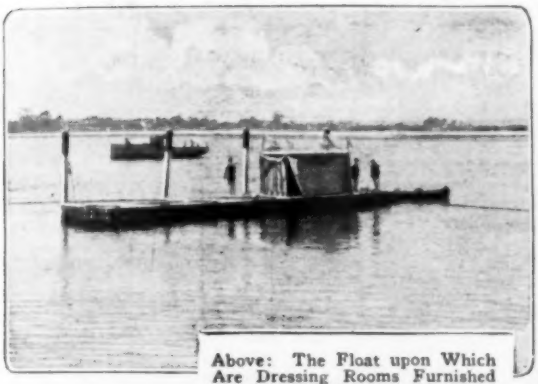
A passenger-carrying monoplane will soon be placed on the market, according to an announcement by the chief engineer of a well-known French firm. It was formerly believed that the monoplane was not adapted to extensive passenger carrying, but recent experiments in Europe have encouraged the production of this type of machine. The new plane has a carrying capacity of 15,000 lb., including the weight of the machine. The wing span is 93 ft., the height 10 ft. 5 in., and the length 56 ft. 8 in. It will be equipped with three 400-hp. Liberty motors or three 370-hp. Lorain-Dietrich motors.

POSITIVE ROTARY PUMP THAT EMPLOYS NOVEL PRINCIPLE

Positive rotary pumps, as distinguished from the centrifugal or turbine types, have up to the present not been very efficient on account of an excess of friction in any type that can obtain good suction, and in the types where there is absence of friction, there is poor suction. There has recently been put on the market a rotary pump which, it is claimed, has the positive properties of the reciprocating pump without any additional friction. It can also be run at much higher speeds, and therefore is of much greater capacity for equal sizes and weights, and has the advantage of being valveless. The pump is composed of two rotating elements, one within the other and eccentric to it. It is in the novel shape of these two elements that this pump differs from other rotary devices. The outer element is circular, and fits rotatably a stationary inclosed housing. Internally it is in the form of a square with circular corners and convex sides. The inner element is in the form of an equilateral triangle, similarly curved at its angles and sides. These two elements thus form rotors which, when mounted eccentrically one within the other, as they rotate together, mesh in such a manner that there are progressively expanding and contracting chambers between them;

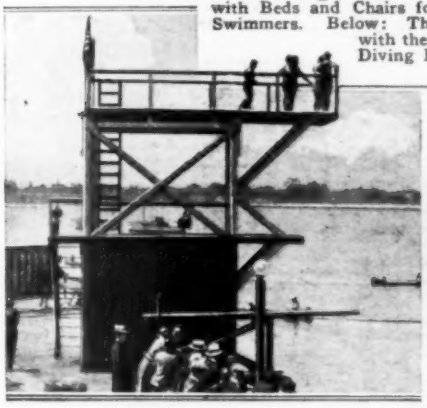


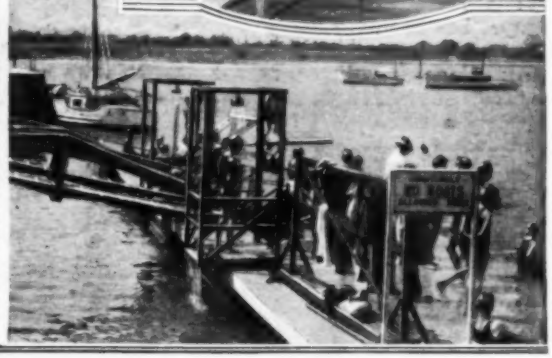
Rotary Pump Unassembled, Showing the Two Rotating Elements with Pulleys and Shaft to the Right of the Housing and Base, and the Two Inclosing Heads in Front



Above: The Float upon Which Are Dressing Rooms Furnished with Beds and Chairs for Tired Swimmers. Below: The Float with the Double Diving Platform

One-Piece Platform and Springboard: The Diver Jumps Down upon the Springboard, Getting a Much Stronger Impulse





Right: This Float Has Pipe Connections to the Water Supply Ashore, Making Always Available the Showers with Which It is Equipped. It Is Accessible from Land by a Gangplank

and as their contact is rolling, and not sliding, there should be little friction. The inner triangle rotor is keyed to the driving shaft, upon which are pulleys by means of which the pump is belt-driven.

UNUSUAL BATHING FACILITIES PROVIDED IN SAN DIEGO BAY

Accommodations and accessories that furnish every conceivable form of natatory enjoyment have been placed at the disposal of the public in the open water of San Diego Bay, at Coronado, Calif. These conveniences are in the form of large floats, each having a different purpose. Accessible from land by a gangway is a float for divers and swimmers that is equipped with fresh-water showers, which are particularly desirable after bathing in the briny waters. The piping from the shore to the showers is arranged to accommodate itself to the changing levels of the float as the tides rise and fall, so that at all times there is a flow of fresh water. Another float is equipped with dressing rooms furnished with beds and chairs, so that they can be used as restrooms by tired swimmers. All kinds of facilities for diving are provided in other floats, one being fitted with a springboard, and above it a platform, from which divers jump to the board. On another float are platforms at various levels so arranged that high diving can be done without any danger of colliding with divers from lower levels. The waters surrounding these floats are brilliantly illuminated after sunset, making bathing as enjoyable in the evening as in the daytime.

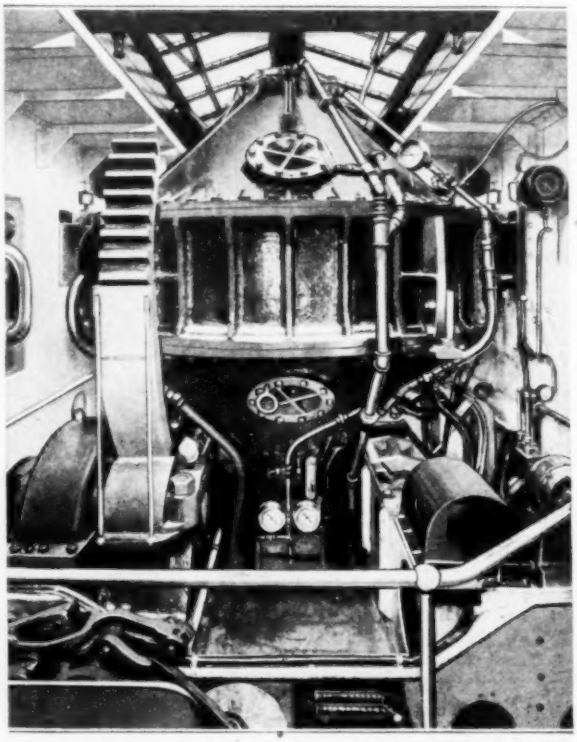
¶ Wireless telephone communication over a distance of 2,712 miles between the Nauen station, near Berlin, Germany, and the Argentine steamer "Bahia Blanca," was recently established. The messages were distinctly heard aboard the ship.

GIANT GYROSCOPES STABILIZE OCEAN LINERS

By GEORGE F. PAUL

MANY a dizzy and distracted transatlantic passenger who has clung feverishly to the banisters when the good ship rolled in the trough of the sea has prayed fervently from the bottom of his well-shaken heart that said good ship would meekly tie up to some stout hitching posts in mid-ocean and let him sip his evening soup in peace.

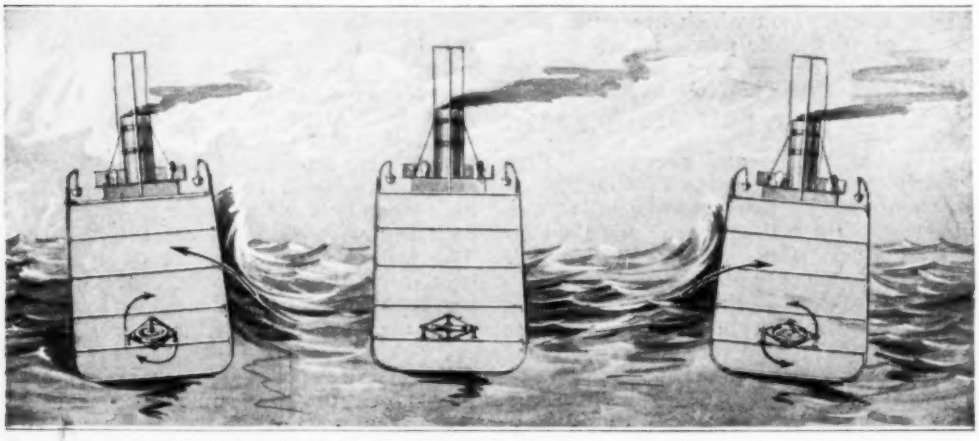
His fervent prayer has been granted, thanks to modern inventive genius, but with this modification—that the ship can now carry its modified hitching posts with it and that they are on duty both day and night.



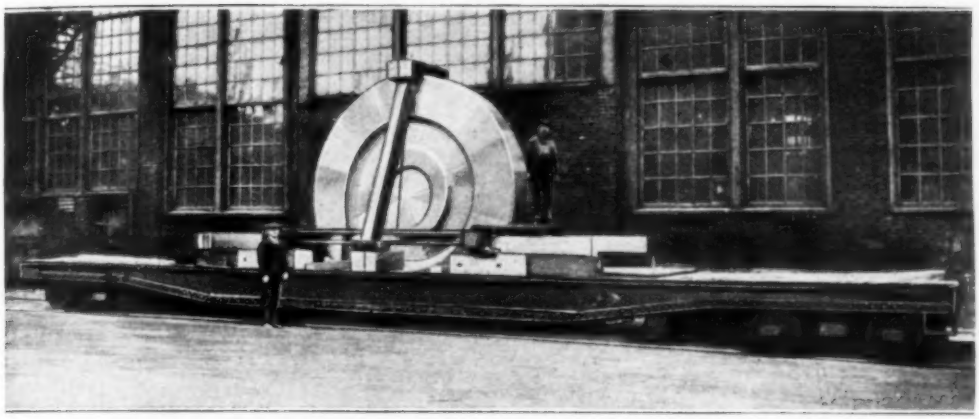
Stabilizer Installed in the Interior of a Ship in Such a Manner That When the Gyroscope inside It is Spun It Prevents the Ship from "Rolling," or Oscillating from Side to Side

Every boy who has spun a gyroscope and watched it perform its gymnastics in thin air has learned through actual experiments the operation of Newton's first law of motion, which states that all matter is pig-headed by saying that "a body continues or perseveres in a state of rest or of uniform motion in a straight line except in so far as it may be deflected therefrom by an externally applied force." This law, when applied to a rotating wheel, may be expressed by stating that the wheel tends to maintain the direction of its plane of rotation, and axis, in space.

The theory of the modern ship stabilizer calls into play this characteristic of the rapidly whirling gyroscope to maintain its axis of spin or plane of rotation rigidly in any direction. So



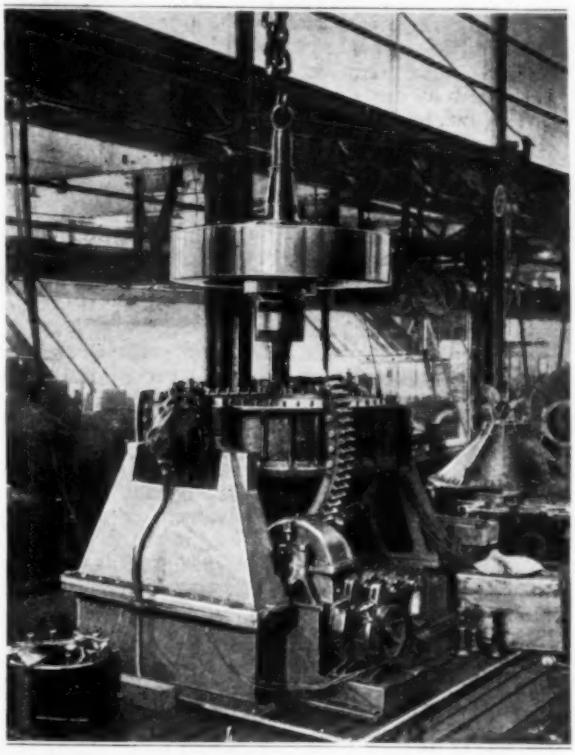
Three Diagrams Showing How the Gyroscopic Stabilizer, Seen inside the Hull, Maintains the Ship in an Approximately Vertical Position in Spite of the Heavy Waves That are Striking Its Sides, as Shown in the Left-Hand and Right-Hand Diagrams. The Center Diagram Shows the Ship in Its Normal Position



Loaded upon a Railroad Truck Is One of the Big Gyroscopes Used for Stabilizing Ships in Heavy Seas. The Gyro Wheel Is Vertical, and Its Large Diameter will be Seen by Comparing It with the Man Standing beside It. Obviously Its Hub Provides for a Very Substantial Spindle

powerful and persistent are the inertia forces in this wheel that it opposes with great effort any disturbing forces, resisting them (up to the limit of its power) with an equal and opposite magnitude. In the case of a ship, the disturbing forces are the waves.

When the powerful action of the waves tends to roll the ship, the spinning gyroscope, being dislodged from its vertical plane of rotation, at once opposes this rolling action by an equal force. The big wheel tilts in the proper direction, fore or aft, in a plane at right angles to the disturbance. Practically all of the power used to stabilize the vessel comes from the very waves that are creating the disturbance. In other words, the vessel is ultimately stabilized by the very force that tries to roll it. The stabilizer really does only a smaller amount of work on the vessel than each wave, but in an exactly opposite manner, with the net result that the effort of the wave is neutralized and the ship does not roll. The gyro merely performs the function of passing the forces "around the corner"; that is, taking in the forces on one side and passing them out as equal but opposing forces at right angles. In opposing the roll of the ship, the gyro is oscillated slowly fore and aft, the speed being governed by suitable control apparatus, so that the gyro will make just one complete oscillation while the tendency of the ship to roll persists.



The Base of the Housing Installed inside a Ship: The Gyroscope, That When Spinning Stabilizes the Ship, is being Lowered into It. The Top Part of the Housing is Seen in the Background

The inventors seized upon the fact that the ever-changing period of the waves, acting on the constant period of the ves-

sel, builds up a large angle of roll, and then, as the waves get out of time, undo their work by opposing and crushing out the roll.

The function of the "control gyro," which acts as the brains of the mechanism, is to pick up the slightest tendency of the ship to roll and to pass this information by closing a contact to what is called the "precession-control unit." This releases the brake and starts the precession motor in the proper direction to tilt, or precess, the main gyro, and bring into play the forces that prevent the ship from rolling.

The gyroscope which furnishes the reactional power consists of a cast-steel wheel, or rotor, mounted in suitable bearings to carry its reaction through the steel casing and gudgeons to the vessel. In all experiments, with the exception of those for the largest battleships, one wheel mounted with vertical axis was sufficient to control the motion of the vessel.

Early experiments with the first rotor, some 50 in. in diameter, and revolving at 2,400 r.p.m., showed that at this relatively high peripheral velocity a considerable amount of power was used in agitating the air near the whirling wheel. It was necessary to find some means to conserve this power. And since the loss is directly in proportion to the density of the air in which the gyro revolves, the entire unit is inclosed and run in a partial vacuum.

The gyro wheel is run by a simple alternating-current, squirrel-cage motor, with no brushes or slip rings. For the high rate of speed at which the wheel travels, a considerable supply of oil is necessary. This is automatically maintained at the proper flow by a gear pump connected to the rotor shaft.

The vacuum is secured and maintained by a simple automatic unit, made up of a small pump with electric motor and a diaphragm that controls the cut-off switch. When once set to 18 or 20 in. of vacuum, this little unit will start and stop automatically to maintain this degree of exhaustion in the gyro casing.

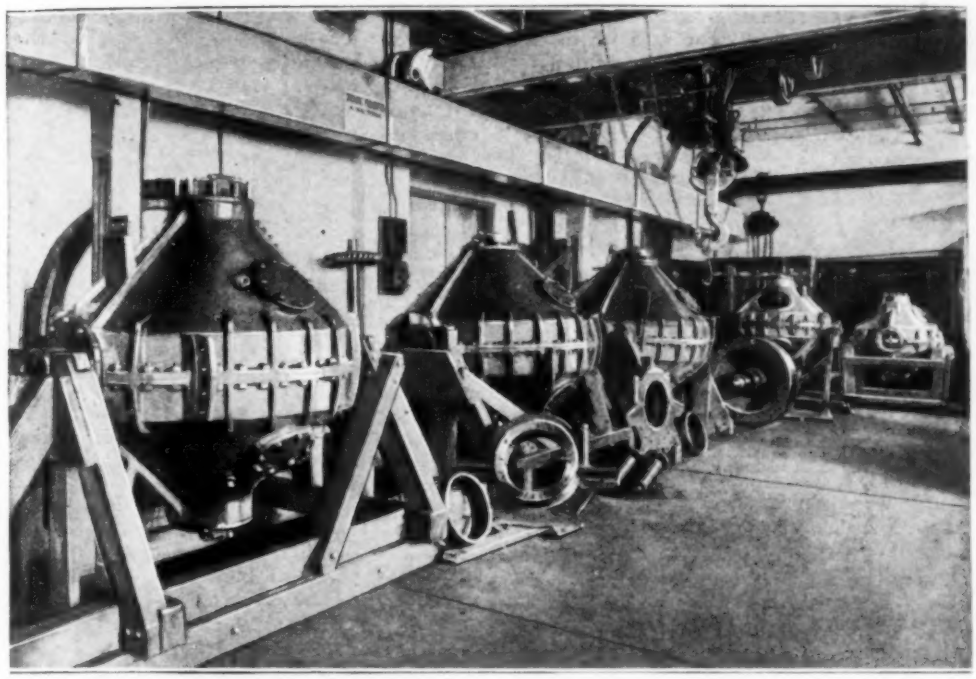
The gyroscope might be said to lift itself with its own boot straps, and it is just because of this that the sensation of being able to control, at will, the roll of a vessel is so difficult of expression. To have the vessel brought upright and held there by the apparent lazy fore-and-aft precession of the gyro, while the waves persist as before, is a startling and pleasing experience. The vessel rises and falls gently as the waves pass under, but the severe rolling is entirely eliminated and the yawing and pitching to a certain extent decreased, for it is found that the three motions of a vessel are closely interrelated.

The same force of the gyro which is used to oppose the action of the waves can be employed to roll the vessel in calm weather. That is, by simply reversing the current in the control gyro, the main gyro is oscillated back and forth in the proper period to exert a force on the vessel, first one way and then the other, to build up a roll of considerable magnitude, depending on the power of the motor. Thus the installation can be used for the amusement of those seafaring individuals who would not feel at home on a calm day; it has also been used on several occasions to roll vessels off sand bars and mud banks on which they were lodged. Huge ice breakers and car ferries are now limited in their usefulness by frequently becoming frozen into the ice. The gyroscope will enable these vessels to crush their way through heavy ice formations.

The question may be asked, "Doesn't a vessel that is held upright in high seas suffer heavier stresses than if permitted to roll and wallow?" The answer is "No"; and in fact there is a marked reduction in the stresses, the reasons being, first, that the vessel, when permitted to roll, becomes stored with thousands of tons of dynamic energy, and when waves come out of phase this energy is absorbed as strain in its members or taken out by the blows of the waves in opposing the roll; and secondly, that, when the stabilizer is in action, the energy of the waves is absorbed by the stabilizer and not by the ship. Even though heavy seas are running, they slap gently against the side of the vessel, for the rolling velocity is low. The velocity is in direct proportion to the angle of roll. The force of the blow struck by the wave is equal to the mass equivalent (displacement) of the vessel times the velocity squared. Thus, in one instance, the waves exerted a force on the vessel 49 times greater during the maximum roll than when it was stabilized.

Some of the advantages of the stabilized ship may be stated as follows:

For ocean liners and merchant vessels that are obliged to sail regardless of the weather, encountering heavy storms on long voyages, the elimination of rolling means added comfort and ease to the passengers. To those who are made ill by the ceaseless rolling of a vessel, it means that they can for the first time enjoy an ocean trip. The yacht owner is assured of a calm passage in any weather, and his



In Part of the Plant Where They are Manufactured Are Several of the Gyroscopic Ship Stabilizers, All Completed and in Wooden Frames Ready for Shipment. The Gyroscope Itself is Mounted inside the Heavy Housing, Which Parts at Its Center to Admit It. Above and Below Are Bearings for Its Spindle

guests rejoice accordingly. He is made independent of weather conditions, and can take trips that otherwise would have to be postponed on account of rough seas. What stabilizers would mean by bringing comfort to the sufferers on hospital ships is apparent to everybody. In rough weather, vessels are sometimes obliged to change heading and go hundreds of miles out of their course, in order to save lifeboats and other gear which might be carried away when the ship rolled violently. Stabilizing the vessel also results in a saving of time and power, owing to the ability to maintain the shortest course between two points in bad weather.

The elimination of wallowing results in a considerable saving in power and fuel, for the greater percentage of the force required to drive a vessel through the water is consumed in pushing aside the tons of water the vessel displaces and overcoming the friction of this water against the wetted surface of the vessel. It has been computed that in a high sea a 15,000-ton vessel at 20 miles an hour would lose 1,000 hp., or over four times the power required by a stabilizer to prevent this loss.

The increased ease of navigation in rough weather is best shown by the recent experience of the "Whileaway." This vessel ran into heavy weather before the situation was realized; the boat rolled and wallowed at dangerous angles, heavy seas coming on board and carrying away a forward structure and rail. As soon as the stabilizer had been thrown in, the vessel righted itself and proceeded on the intended course—in the terms of the captain, "steering herself."

Bilge keels, while bringing about a reduction in large angles of roll, prove a considerable retarding factor, being a continual drag on the forward motion of the ship, whether it rolls or not. The power to drive these huge surfaces through the water is in proportion to that absorbed by the skin friction of the entire vessel. Thus for a 37,000-ton liner at 26 miles an hour, 2,350 hp. would be absorbed.

The roll of a vessel introduces tremendous stresses in its hull, engines, and auxiliary—in fact, in every part of the ship. These are inertia forces introduced by the high velocity of motion set up by the wave action. The largest stresses are caused when the waves change phase and dash against the vessel, crushing out a portion of the roll. The impact results in a stress similar to that when any two bodies in rapid motion meet. It some-

times happens that the sides of the vessels are crushed, and once in a while, the ribs crack and the plates are buckled by the stresses of the wave impact.

Ships carrying live stock often suffer heavy losses in storms. Figures have been furnished by a concern carrying horses during the war, showing that in a heavy storm during a single trip their losses often amounted to $30,000.

Ingot Weighing 275,000 Pounds from Which was Made One of the Ship-Stabilizing Gyroscopes with a Diameter of 13 Feet That When Finished Weighed 50 Tons

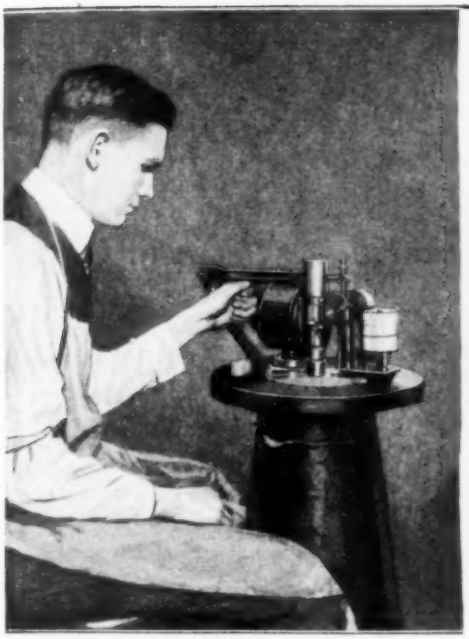
When running in heavy seas with the vessel wallowing, it is often necessary to shut off the engines as the propeller leaves the water in order to prevent racing and reduce the strain resulting from the sudden plunge of the screw back into the water. The stabilized battleship can go into action in any state of weather, no matter what the condition of the sea may be. The members of the crew are far more efficient on such a battleship. From the standpoint of gun fire alone, a stabilized navy would have a very great advantage, even in moderate weather, over an unstabilized navy. The sole object is to make hits, and if the number of hits can be doubled, it means the virtual doubling of the navy.

The greatest contribution of the stabilizer to naval vessels, however, will be in assuring the effective operation of the directive fire system. As a battleship cruiser or destroyer is but a navigable fortress, to permit maneuvering the guns into action, all other machinery is subsidiary to that controlling the placing of the guns. In the olden days gun control consisted only in individual aim firing as the sight crossed the target. Next came into play the continuous aim by which the gun was kept continuously on the target and fired on signal, to avoid interference of one gun with another. But the accuracy sought was not attained, and the use of longer-range guns called for a more centralized control and a higher order of precision in setting the guns. This was provided in the director fire system developed in 1911. In this system all the guns are fired in salvo when the ship reaches a predetermined roll. The great advantages are in unified control and grouping of hits. The effectiveness, however, depends upon the reliability of the predetermined roll, and unfortunately neither the amplitude nor frequency is constant. In a rough sea, there is too much roll; in a calm sea, not enough. The active stabilizer, however, can produce constant roll and thus insure ideal conditions for effective director fire.

Thus, whether a vessel starts out on an errand of peace or a mission of war, the success of its particular venture can in many instances be insured through the aid of such modern inventions, foreshadowing the days when the seas will be robbed of many of their perils, and ships will be independent of wind and wave.

STAMP CASE USED AS REMEDY FOR LACK OF SMALL COINS

Since the war, coins used for small change have been very scarce in most European countries. For this reason an enterprising tobacconist, in Belgium, manufactures his own small change in the shape of a light circular white metal frame, large enough to accommodate one postage stamp, which is bound in it by a transparent celluloid cover. The token passes at the face value of the stamp, and the tobacconist covers the cost of its manufacture by the value of the advertising embossed on its metal back. Hereon are printed in bold type his name and address, and a strong recommendation of his wares.



An Impact Machine Which Smashes Rock-Test Briquettes to Determine the Binding Quality of the Material for Roadbuilding

MACHINE USED TO STUDY BINDING QUALITY OF ROCK

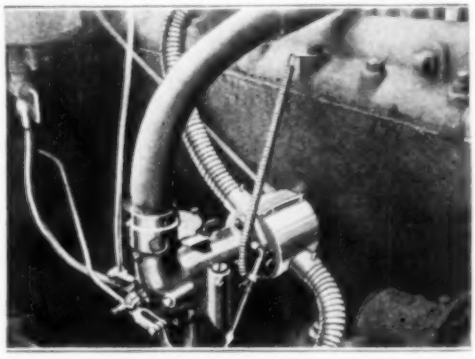
Rock for roadbuilding must be tested as to its binding quality before it can be used in the important service, and to perform the tests the United States Bureau of Public Roads is using a mechanical process. A 500-gram piece of rock is crushed to pea-size, and after being mixed with water, is placed in a ball mill where it is worked at 30 r.p.m. for a certain length of time. The resulting dough is then pressed into cylindrical briquettes of uniform size by another machine. After drying for 20 hours at room temperature, these briquettes are heated at 100° C. for four hours and then cooled for 20 minutes before they are sent to the impact machine. Here the supreme test is made. The sample is placed on a block, and subjected to the impact of a spring-held plunger, which transmits the blows from a cam-operated hammer at the rate of 60 a minute. The force of each blow is recorded on a drum by a pencil fixed to the plunger.

¶The Hudson's Bay Company is establishing posts in northern Siberia. One of the first cargoes for that country from Canada included many rolls of wall paper.

Test Briquettes of Rock and Water are Formed in This Device at the Bureau of Public Roads. The Rock and Water are Compounded in Exact Amounts for Accurate Results

CARBURETOR-HEATING DEVICE FOR AUTOMOBILE MOTORS

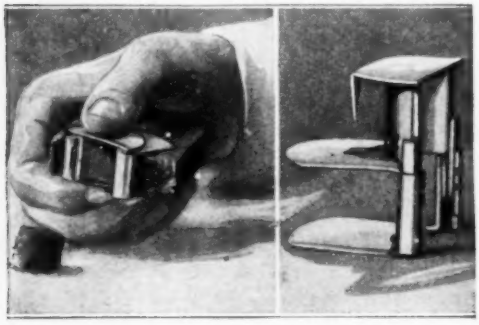
In automobile motors present-day low-test gasoline makes some heating means in connection with the carburetor indispensable. There are many cars with their own special method of doing this, but recently a device that can be attached to any design of motor has been placed on the market. It is in the form of a closed cylindrical attachment to the intake of the carburetor, containing a smaller aluminum cylinder through which the intake air passes, and which is shaped so as to have a large radiating area in proportion to its size. To the outside cylinder are connected pipes that conduct the exhaust gases from the motor, heating the inside aluminum cylinder, and then pass to the muffler, or any other point of exhaust.



Heating Device Attached to Intake of Carburetors on Automobile Motors That by Means of the Hot Exhaust Gases Helps the Vaporization of Low-Test Gasoline

CIRCULAR-KNIFE DEVICE CLIPS OFF "CHEW"

A Californian manufactures an instrument with which the user of tobacco can "bite off a chew" neatly and quickly. The



Right: The Tobacco "Biter" Ready for the Plug. Left: Just After the Circular Knife has Cut a "Chew" from the Plug

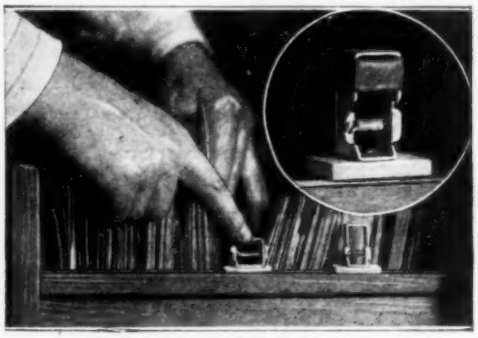
chew is cut from the plug, held between two lower plates of the "biter," by pressing down on a curved blade. When not in use, a prong running into the plug holds the device ready for further service.

CARS WASHED AND POLISHED IN MODERN AUTO LAUNDRY

To satisfy his customers when washing their cars, a Lincoln, Neb., garage owner has installed a series of racks and platforms on which the car moves from one operation to another, like soiled clothing in the modern laundry. The whole installation is in the open air. The car is first dusted; all parts of the upholstery are reached with a vacuum cleaner and a stream of compressed air. Washing is next, and as tiny sprays of water eat away and loosen the dirt, the surface of the car is gone over with soft sponges and clean water. Compressed air is used on the drying platform to blow the water from the surface, which is then thoroughly dried with chamois skin. This process takes only an hour.

DEVICE SHOWS FILING PLACE OF WITHDRAWN FOLDER

There will be no mistake in the replacing of folders in the filing cabinet, and no time lost in searching for its correct placing, when a recently patented indicator is used. The device runs in a groove in a block fastened to the side of the filing drawer, and is pressed into place with the finger when a folder is removed. The pressure of the folders themselves is sufficient to hold the indicator in position. Replacing the folder releases this pressure, and the indicator springs up.



The Little Marker is Fitted In Where the Papers are Taken from the Files. Insert: The Marker

The Cars on the Platform at the Right are Going through the Various Stages of being Washed; Those in the Shed at the Left are being Dried before Delivery

PALATIAL OCEAN-GOING STEAMSHIP CARRIES COMPLETE PRINT SHOP

THE steamship "Aquitania" carries its own complete print shop, which is equipped with two electric motor-driven Gordon presses, type cabinets containing different styles and sizes of type, paper stock, and all the other accessories necessary for the printing of the daily menus and radio bulletin, entertainment programs, and ship stationery. When the ship rolls at as much as 30 or 45°, the printer works under rather trying circumstances. The type cases sliding out of the cabinet, the forms slipping off of the stone, and even the presses breaking away from their fastenings, must not interfere with the prompt delivery of the work.

OLD STREET CARS USED IN HOUSE CONSTRUCTION

To "beat" the high cost of building materials, one Washington builder has constructed a house in which two obsolete street cars form the major portion. The cars were placed some distance apart and their inside walls torn out. Over the whole a gable roof was built, which extends outward far enough to be in parallel alinement with the outsides of the cars. Suitable walls were built between the car bodies to complete the unit.

This Washington House is Built of Two Obsolete Street Cars with a Few Wall Sections in Addition

PHOTOGRAPHING YELLOWSTONE PARK AT NIGHT

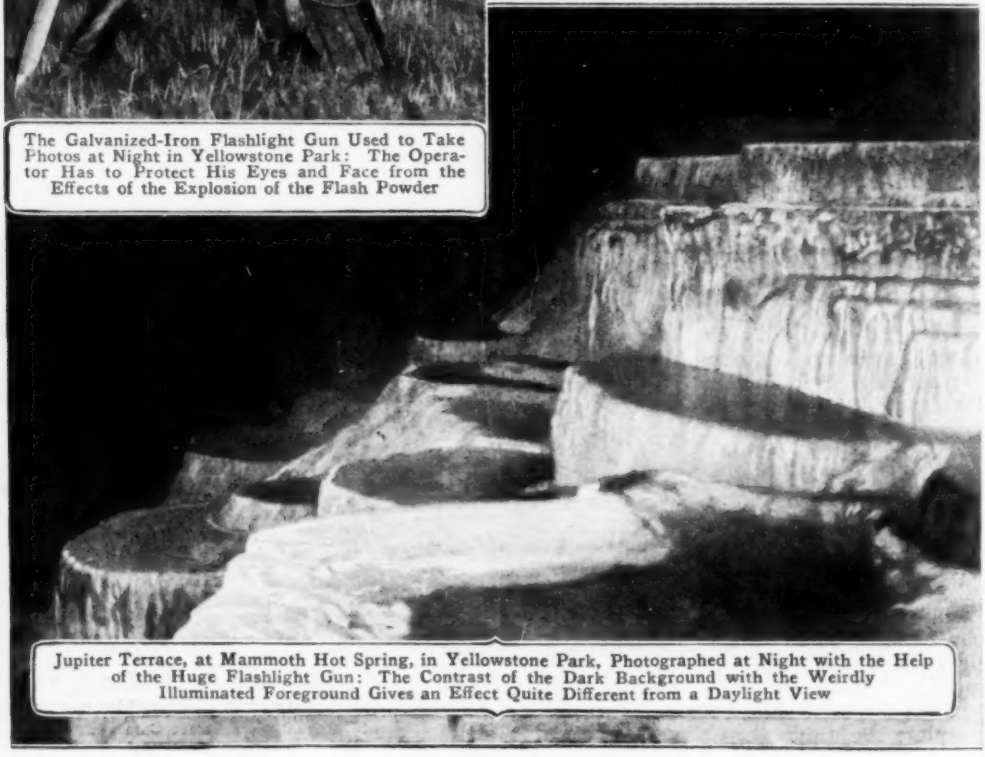
By JACK A. BRISTOL

WITH specially constructed speed illuminating apparatus, the largest ever used, an enterprising crew of newspaper men have succeeded in photographing "Old Faithful" in action at night for the first time in its history. Other geysers, waterfalls, boiling-spring formations, and various wonders of Yellowstone Park were also taken at night for the first time, giving them a weird appearance never seen by the daytime observer, but the real achievement was the snapping of Old Faithful.

Three times—temporarily blinded by the huge charges of powder—men of the camera crew were led into the neighboring inn, some of them remaining "out" for more than an hour. Five times Old Faithful was "shot" without success. Finally, with a battery of several cameras grouped on one side of the famous geyser, and the huge gun on the other, a successful flash was made, catching the geyser at the apex of its sensational action. The equipment which caught the successful picture was a 4 by 5 high-speed camera, using an F-4.5 lens.

In construction, the flash gun is a galvanized-iron device, in the shape of a cone with a maximum diameter of 3 ft. It is supported on three legs, each attached with three bolts. Inside of the cone is a pan which will hold 1 lb. of high-speed flash powder, electrically ignited to furnish positive and absolutely instantaneous action. Four to 10 oz. of extra-fast flash powder were used in each shot, enough to jolt the gun several feet off

The Galvanized-Iron Flashlight Gun Used to Take Photos at Night in Yellowstone Park: The Operator Has to Protect His Eyes and Face from the Effects of the Explosion of the Flash Powder



Jupiter Terrace, at Mammoth Hot Spring, in Yellowstone Park, Photographed at Night with the Help of the Huge Flashlight Gun: The Contrast of the Dark Background with the Weirdly Illuminated Foreground Gives an Effect Quite Different from a Daylight View

The Much-Admired Kepler Cascades in the Firehole River near Old Faithful Inn, in Yellowstone Park, Photographed at Night by Using an Extra-Big Flashlight Gun: The Great Height of the Falls can be Very Well Conceived by Comparing Them with the Pine Trees on the Left

Left: Castle Geyser, in Yellowstone Park, Photographed at Night by Means of a Very Powerful Flashlight Gun in the Hands of a Number of Newspaper Camera Men, Who Also Succeeded, after Four Failures, in Taking the Remarkable Photo, on the Right, of Old Faithful Geyser in Full Action

position every time it was fired, from the tremendous recoil; enough to make the walls of Old Faithful Inn, substantially built of logs, tremble, while the camp was considerably shaken by each flash, which had all the force of a powerful blast.

So brilliant is the backflash from this huge piece of photographic artillery that men of the camera crew who were caught by it were led off the field completely blinded by the magnesium glare. The abrupt and extreme brilliance, stabbing out of the velvety dark, causes the iris of the eye instantly to contract so much that the pupil remains only the most minute opening, or is closed completely. The iris soon relaxes, and the blindness, though utter, is only temporary. After the third experience, the men wore goggles of the type used by electric-arc welders, while the man firing the gun was goggled and muffled to the eyes.

The difficulties in taking night pictures of the famous geyser appeared insurmountable for a time. Cameras were set up and focused by daylight, taken down without disturbing their adjustment, and then, at night, reset in exactly the same place, on carefully marked locations, and as carefully checked tripods. Only by the sound of the geyser could the action be judged, and as it is more or less sporadic, it was extremely difficult to touch off the flash gun at the exact moment when it was at its height. And furthermore, the coolness of the nights in Yellowstone caused the geyser to give off heavy steam clouds.

"Shooting" hot-spring terraces, waterfalls, and other still subjects was comparatively simple, though the effects secured were sensational and spectacular. One park official, looking at the night picture of Jupiter Terrace, remarked:

"There are the mountains of the moon for you!"

Others declared that the photographs secured by these newspaper men were the most unusual ever made in the big national playground.

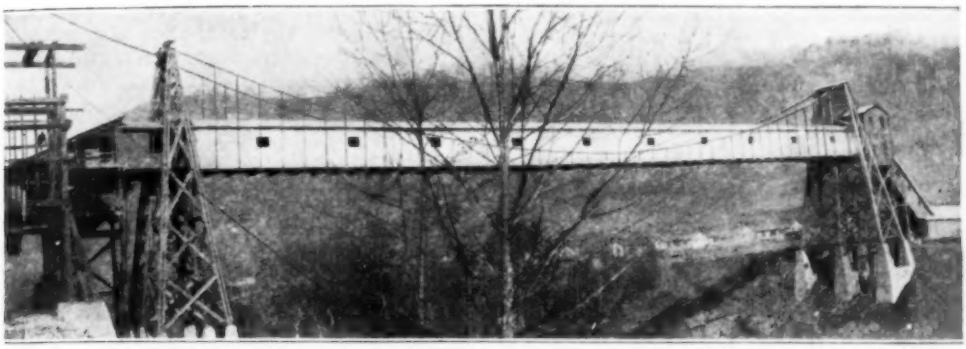
SEARCHLIGHT-EFFECT HEADLIGHTS HAVE NO GLARE

The Dangerous Dazzle Made by the Ordinary Automobile Headlights: Without an Antidazzle Device the Only Remedy Is to Dim the Light

The Same Headlights with the New Device, Showing How the Dazzle is Eliminated without Dimming the Lights by Giving Them a Searchlight Effect

The Antidazzle Device is So Completely Hidden inside the Automobile Headlight That It does Not Affect Its External Appearance

A device designed to fit just behind the lens of the ordinary automobile headlamp, is for the purpose of eliminating the glare without decreasing distance penetration of the light. It consists of a series of metal slats crossing at right angles in front of the bulb so as to form spaces which are ⅜ in. square and 1½ in. deep. These cellular spaces gather up the rays of light into a searchlight beam projected forward on such a level as to be below the normal line of vision of the person approaching. In this manner all side glare is eliminated but the full candlepower of the lamp is retained for illuminating the road. A circular frame inclosing the metal strips is adapted to fit inside the parabolic reflector, and is held in place by means of setscrews. The device originated in England, where it has been demonstrated.



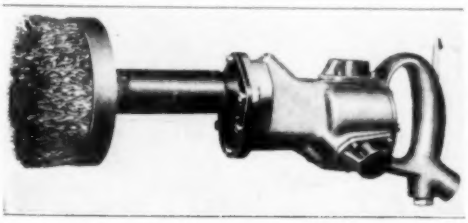
Two Galvanized-Steel Cables, Two Inches in Diameter, Carry a Coal Conveyor over the River. The Coal Fields Are on One Side and the Railroad on the Other, the Conveyor Connecting the Two

COAL CONVEYOR SPANS RIVER ON AN UNUSUAL BRIDGE

A large coal-mining company with holdings along the Big Sandy River in Kentucky was confronted with the fact that the river separated its coal fields from a railroad. Some sort of transportation means was necessary to carry the coal over the water, and an unusual bridge of the suspension type was erected. From two tall steel structures, located on opposite sides of the river, two 2-in. galvanized-steel cables were hung. From these, hanger rods were suspended, supporting a floor on which a belt conveyor was built. The conveyor carries the coal from the mine workings to a tipple on the opposite side, for loading on the cars.

WIRE BRUSH IS LATEST PNEUMATIC APPLIANCE

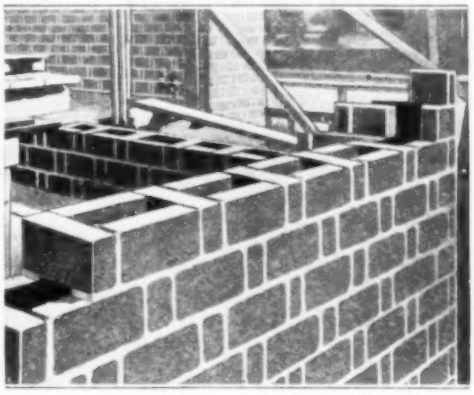
Stampings, scorings, and other markings of importance on castings, forgings, etc., often get hidden by coats of dirt and rust. Heretofore, hand-operated brushes with stiff wire bristles have been used to clean off such accumulations. A rotary air-driven brush which does the work thoroughly and very quickly, now displaces the older tool. The new device consists of a heavy circular base which is equipped with suitable fittings for entering the tool slot of a pneumatic drill. This base retains the special-steel bristles used for the cleaning, and whirls when the compressed air is admitted.



Air Pressure Whirls the Brush Which Fits into the Tool Slot of the Pneumatic Drill. The Bristles Are of Special Steel

HOLLOW BRICK WALL BUILT FROM REGULAR-SIZE STOCK

A house, built of brick at a cost no greater than that of the ordinary frame dwelling, is the plan of a Western brick manufacturer. The brick, 8 by 4 by 2 in., manufactured as regular face-brick stock, is laid to form an 8-in. hollow wall with a 4-in. air cell throughout the entire structure. Only nine bricks are required for each square foot of wall. A tie is formed between the inside and outside faces of the wall by the use of the so-called Flemish bond, where a full brick is laid, in each course, at right angles to the wall every 8 in. This also adds to the pleasing appearance of the walls.



Laying Every Other Brick So as to Tie the Faces Forms a Cheap, Strong, and Well Ventilated Wall. It Has the Advantages of Brick at the Cost of Wood

FOLDABLE WHEELBARROW TAKES LITTLE ROOM

Storage room in the basement or woodshed of the backyard gardener is generally at a premium, and to minimize the storage space required for the wheelbarrow, a collapsible barrow has been designed. The wheel of the appliance is removable. Hinges are provided for the folding of the handlebars, legs, and front against the bottom. The unit can then be easily carried about or stored in a small space.

The Handlebars, Legs, and Front of This Wheelbarrow may be Folded against the Bottom. Insert: The Barrow Folded

MUSEUM BUILDING HOUSES ARMY MOTOR VEHICLES

One each of the various types of army motor vehicles, formerly scrapped after serving their purpose, are now housed for exhibition and reference, in a building at the Aberdeen (Md.) Proving Ground. They are there together with various types of past, present, and experimental machines, and also those obtained from the allies during the World War or captured from the enemy. All the machines are kept in as perfect condition as possible for operation in tests. The intention is to have one of each of the standard approved army vehicles ready for inspection by manufacturers in case of a necessity for quick production. "Old Betsy," the first five-ton tractor constructed under the supervision of the Ordnance Department, the first 10-ton tractor, a German 42-cm. howitzer tractor, and others, form part of the exhibit.

SCIENCE USES PARASITES TO FIGHT FLIES

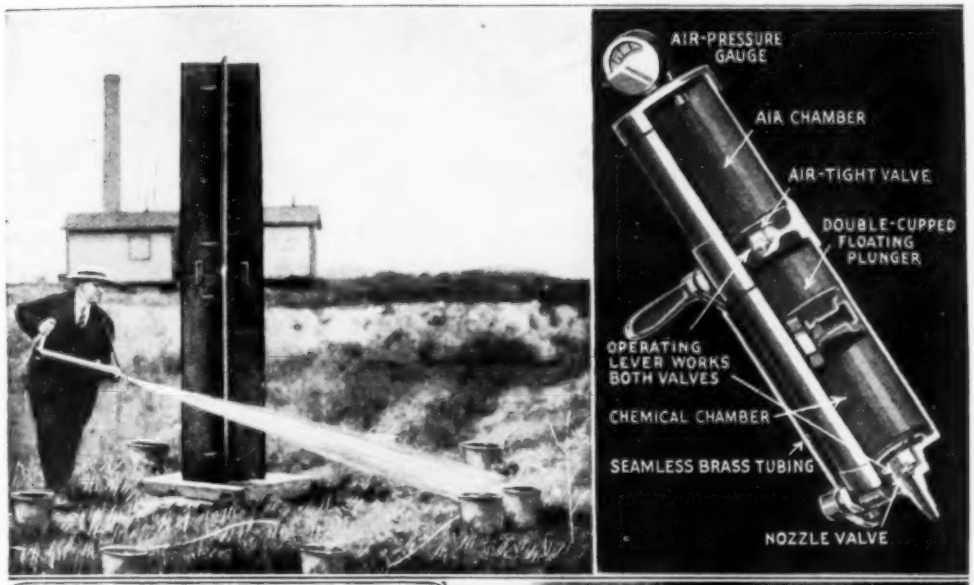
Ever since the campaign for the destruction of the house fly began, scientists have tried unsuccessfully to make use of the fly's natural enemy, a parasite fungus known as Empusa Muscæ. This parasite enters the fly's body as a sperm and quickly causes its death. The dead fly is soon covered with a gray-white coating of thousands of the spores of the parasite, which in turn spread to other flies. It has always appeared impossible to breed the parasite on artificial nutrition or to obtain the spores in sufficient quantity for extensive use against the fly. One laboratory, however, has finally succeeded in cultivating the fungus on a large scale, and has placed a preparation on the market which is composed of the embryos of the fly parasite.

FIELD TELEPHONE HELPS SPEED GOLF-SCORE NEWS

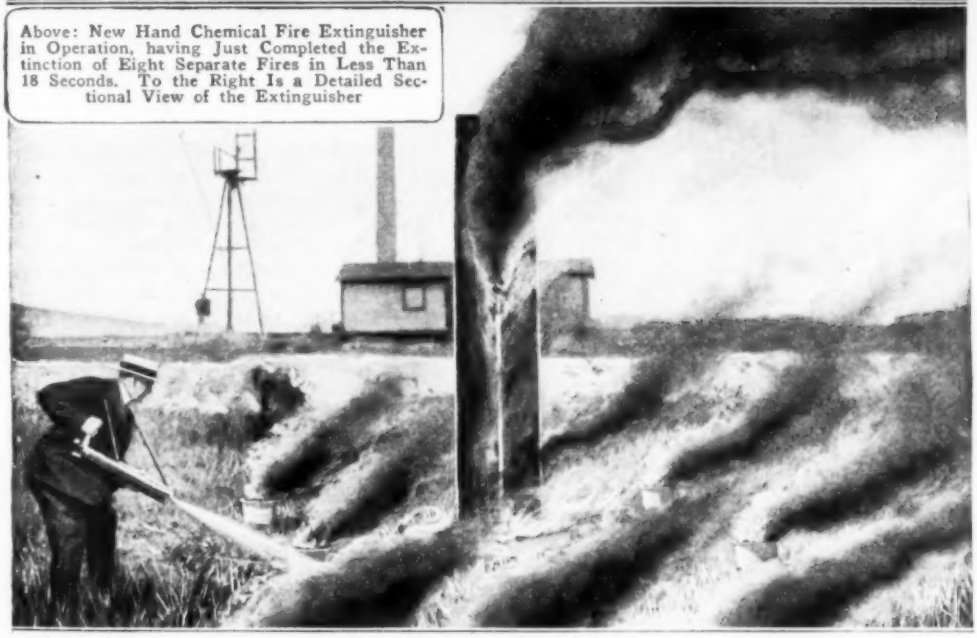
The field telephone of the Signal Corps type has recently played an unusual rôle as a transmitter of golf scores during an important national match held in Washington, D. C. The phone outfit was placed at the ninth or "turn" hole of the course, where a scorer was stationed to await the results that far. As fast as the players arrived, they presented him with their scores, and he phoned them to the clubhouse some distance away. Official scorer and newspaper men were awaiting the results at this point.

Flashing Golf Scores over the Wire to the Clubhouse at the Ninth Hole: An Army-Type Signal Phone is being Used

NEW EXTINGUISHER SUBDUES TWELVE FIRES



Above: New Hand Chemical Fire Extinguisher in Operation, having Just Completed the Extinction of Eight Separate Fires in Less Than 18 Seconds. To the Right Is a Detailed Sectional View of the Extinguisher



The New Chemical Fire Extinguisher in a Startling Demonstration of Efficiency by Extinguishing in Less Than 18 Seconds a Number of Separated Bucketfuls of Burning Gasoline, and Also Four Burning Streams in a Central X-Shaped Wooden Structure. The Operator is Shown Just Starting to Work on the First Fire

Some spectacular demonstrations were recently given at Cleveland, Ohio, of a remarkably efficient hand chemical fire extinguisher. Eight gallons of gasoline in four 2-gal. buckets, bunched together, were ignited, and it required just eight seconds from the time that all were in full blaze for the apparatus to complete extinction. In another test, the eight buckets of gasoline were placed at the corners of a 10-ft. square, in the center of which four boards 10 ft. high were erected in X-shape, and gasoline was caused to run down each of the four troughs. When

ignited, there were 12 separate fires to attend to, and they were all extinguished in less than 18 seconds.

The efficiency of the extinguisher is attributed to certain novel features, the most notable of which is a floating piston, which reciprocates inside the closed brass cylinder of which the main body is formed. This is divided into two compartments by an air-tight partition which has a valve in it. The chamber above the partition is filled with air under compression, a gauge on top showing the pressure. The chemical is introduced into the lower chamber, and below the floating piston. At the bottom of this, projecting from the end of the cylinder, is a nozzle controlled by a valve which is coupled to the valve in the partition, both being operated in unison by one handle. In operation both valves are opened, and the compressed air, by means of the piston, forces the chemical through the nozzle, which sprays it so that, at its radius of operation, it covers an area of about 20 square feet in effective manner.

SET OF LADDERS MAKE NEAT SCAFFOLDING

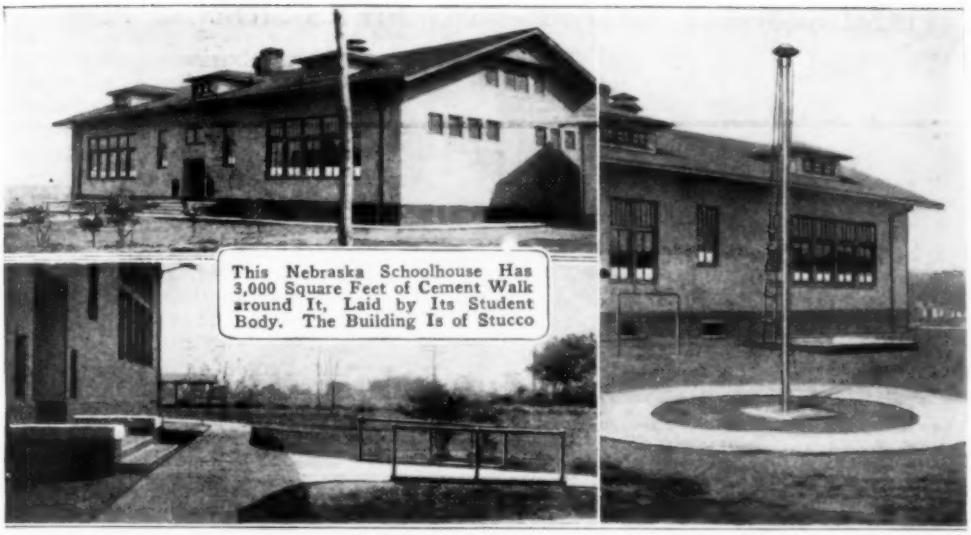
Attachments that will fit any set of extension ladders, at any angle, will make a complete set of scaffolding, requiring no further equipment to cover the area of wall between the ladders. The set of scaffolds are spaced away from the wall, touching at only four points. Two semicircular plates fastened to two short pieces of angle iron, are attached to the top of the ladder sides with four thumbscrews. Two of the screws fit into a series of holes in an arc and hold the ladders at any angle. The lower planks rest upon brackets, hooked over a rung at the inner end; the outer end is adjustable by means of a notched bar supported from a rung above.

Simple Attachments at the Top and at Points Below Transform These Ladders into a Set of Scaffolds Easily Erected and Dismantled. Right: Large View, Showing Attachments in Detail

WIRELESS DISPLACES PHONE IN REMOTE PLACES

The superior efficiency of the wireless as a means of communication is being more clearly demonstrated almost daily. Its latest use as a connecting link between the construction camps and headquarters of a southern California electric company in the place of telephone lines, proves the assertion. These camps are located high in the Sierra Madre Mountains and present insurmountable obstacles to the maintenance of a metallic circuit in the face of extreme weather conditions. A continuous-wave set, radiating 2½ amperes antenna current, has been adopted as the standard communicating means in the installation. The masts for the antenna are tall pine trees stripped of their branches, and from this 540-meter waves are radiated. Further experiments are contemplated in which portable radio sets of 25-mile sending range will be provided for temporary camps out from the main bases. Generating means of sufficient capacity and proper construction are included in the radio equipment, to insure constant power supply for operation.

¶With the revival of a proposal for a tube railway in Calcutta, India, an estimate of the probable cost is being prepared.



This Nebraska Schoolhouse Has 3,000 Square Feet of Cement Walk around It, Laid by Its Student Body. The Building Is of Stucco

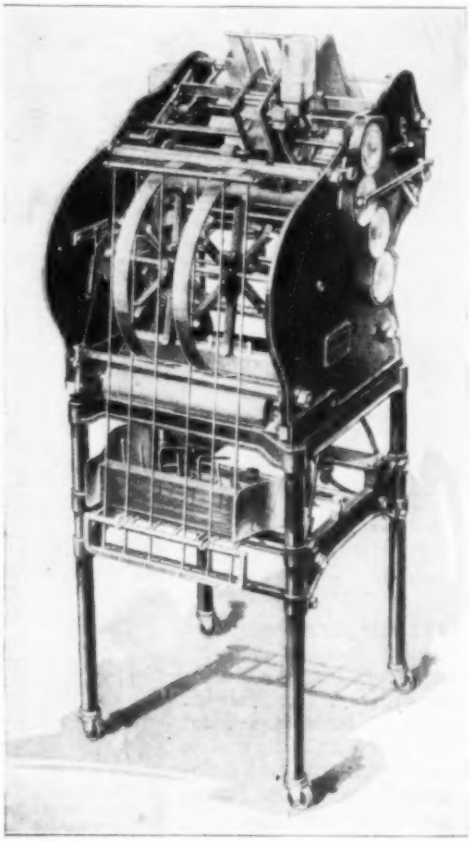
The View at the Left Shows the Cement Walk Leading to the School Entrance; on the Right, a Circular Path of Cement around the School Swing. Although Done by Children, the Work Has a Finished Appearance

COUNTRY-SCHOOL PUPILS BUILD CONCRETE WALKS FOR SCHOOL

From the sodding of the school yard to the planting of trees and shrubs, school pupils have now taken to the laying of concrete walks about the grounds. Taking just pride in their pretty stucco and brick schoolhouse, the pupils of a country school in Nebraska have laid about 3,000 sq. ft. of walk. This includes the walks leading to the highway, circling the building and protecting the various features of a playground in the rear. Everything considered, the job compares favorably with that done by experienced labor. The concrete consisted of five parts of good gravel and sand to one part of cement. No top coat was used, but the surface was well floated.

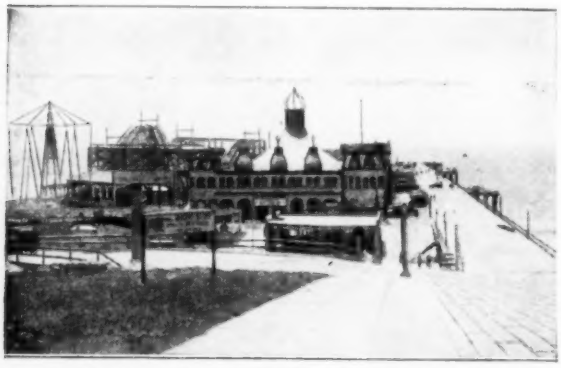
MACHINE SEALS, STAMPS, AND COUNTS ENVELOPES

A machine which seals, stamps, and counts envelopes, or does any one of the operations alone, operates at a rate of 6,000 envelopes an hour. It is electrically driven, and will open the flap of the envelope, moisten it, and turn the flap over the body of the envelope. There is an interval between the moistening and sealing, permitting the mucilage to become gummy. Only one operator is required to feed the unsealed envelopes to the machine and to remove them from the stacker after sealing and stamping.



Moistened and Stamped, the Envelopes are Carried by the Fingers on the Roll-Like Arrangement to the Folder and Sealer Roll at the Bottom

AMUSEMENT AND FISHING PIERS SIDE BY SIDE

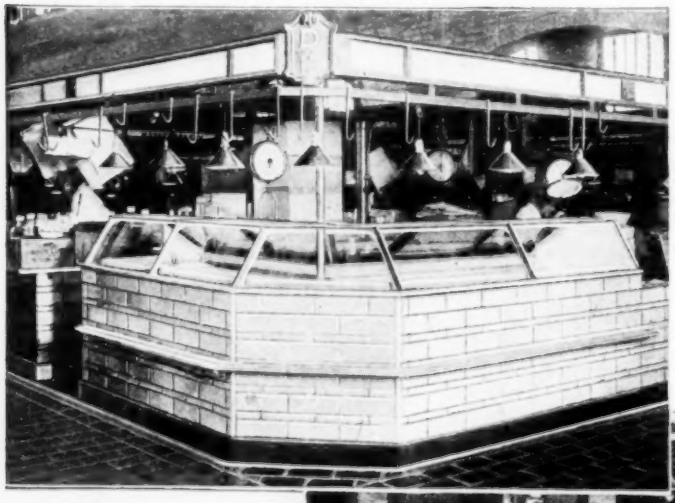


There Is No Fence between the Municipal Fishing Pier, at the Right, and the Amusement Pier of Santa Monica, at the Left

Shrewd business policy determined the erection of an amusement pier at Santa Monica, Calif., alongside of, and moored to, a municipal pier used by fishermen and boats. Prospecting for a suitable location, the amusement concern decided that the patronage of the fisherfolk and the crowds coming in off the boats would be stimulated if there were easy access to the amusement features. The plan has worked well. People on the fishing pier are constantly strolling across to the other pier, attracted by the various amusement devices.

MEAT COUNTER IS SHOP'S REFRIGERATOR

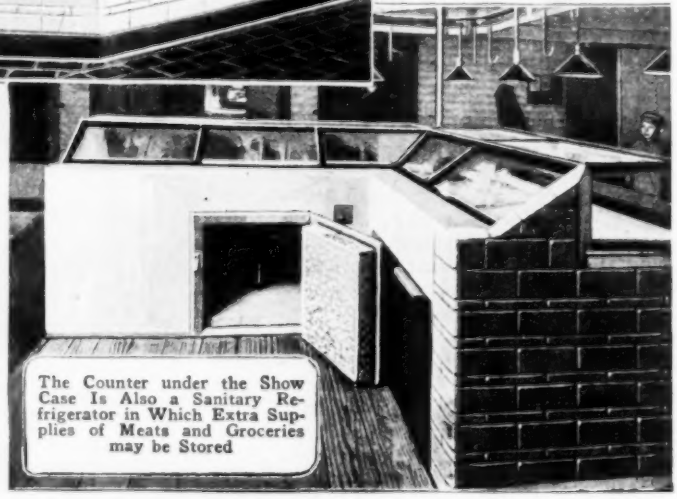
A refrigerated meat counter that provides storage space for meats at a constant temperature of 32° F. and has a glass-inclosed display counter, also refrigerated, which protects the meats from flies and dirt, is a recent innovation of technologists of the United States Bureau of Markets.



This Show Case is Refrigerated by Ammonia Lines and Keeps Flies and Dirt Away. It Is a United States Bureau of Markets Innovation

The invention is the result of a request for Federal assistance by the officials of the new West Side Municipal Market in Cleveland, where despite the $800,000 that had been spent to erect the market, sanitary and efficient refrigeration methods were wholly lacking. At night the meats were transported by truck to cold-storage rooms in the basement. Covering for the counters was not provided, and the meats and other products were exposed to dust and dirt, and more particularly to the menace of flies.

The counter is made of tile, cement, and cork,



The Counter under the Show Case Is Also a Sanitary Refrigerator in Which Extra Supplies of Meats and Groceries may be Stored

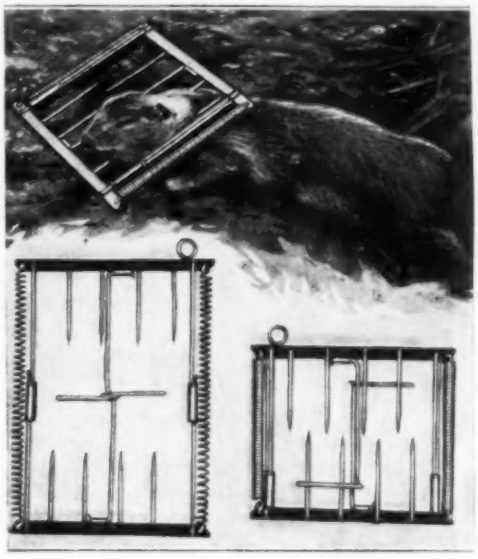
the walls being composed of 3 in. of cork with a cement lining, and a tile facing outside. Refrigeration is provided by means of pipes extending from the cooling plant in the basement of the building. The brine system is used. The display space on the top of the counter is refrigerated by pipes that rest at the bottom of the show case. The sliding glass doors are removable, so as to permit freer access to the counter during busy hours. The entire display compartment is connected with a drain and can be flushed after market hours. Not only are the meats and other products on display kept cool and fresh, but the sanitary glass case has effectively solved the fly problem.

NEW FLYWHEEL RING GEAR IS CHANGEABLE

The automobile flywheel no longer has to be scrapped because the teeth of its periphery which are designed to mesh with the starter pinion are worn. A changeable ring gear, applicable to that part and made in many stock sizes for most cars, is now on the market. The gear is a shrunk fit on the wheel rim, and is further tightened by screws driven at different points about the wheel circumference between the wheel rim and gear. Meshing of the starter pinion with the gear is facilitated by rounded surfaces on the teeth of the latter.

NEW GOPHER TRAP KILLS VICTIMS INSTANTLY

Different from former traps in that it kills its victims instantly instead of mangling the leg or tearing the flesh, is a trap of late design intended for rats, gophers, and similar animals. Two small frames with telescoping iron sidepieces and connected at their outer corners by strong springs, are held apart by a central trip arrangement, and carry sharp spikes on the endpieces. These frames are locked apart by the trip and laid over the hole of the animal. As the latter pokes its head through the trap in search of the bait, it operates the trip and the springs bring the spiked frames forcibly together. The spikes enter the head of the animal, killing it instantly.



This Gopher Trap is Placed over the Gopher Hole. It Snaps Shut as Indicated in the Lower Illustrations, Killing Its Victim Instantly

CLOCKWORK CONTROLS NEW TRAFFIC REGULATOR

A box containing clockwork, capable of being set to various intervals, controls the movements of a glass globe used for the regulation of traffic. The clockwork is operated by electricity, and can be fed from overhead wires, when such are available, or from storage batteries placed in a box on which the column rests. In the latter case, the regulator is portable. The globe, which is lighted by an incandescent lamp at night, has the words "Go," painted in green, and "Stop," painted in red, on alternate sides. With the current off, the globe takes a neutral position. The traffic regulator practically displaces the police officer usually seen at street crossings.

TRIPLE CAPACITY DEVELOPED WITH THREE-ELEMENT FUSE

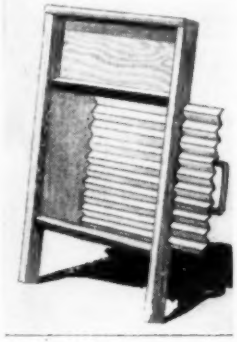
Three fusible elements, placed so that any one of them may be brought into the circuit to take the place of one destroyed, feature a new cartridge fuse recently marketed. Also, two or all three of the elements may be placed in the circuit in parallel, and in this way carry a current two or three times the original capacity of the fuse. The fuses are replaced or arranged in parallel by screwing a threaded plug into the cartridge ends. The three fusible wires are separated in the cartridge by a hard-rubber piece with three branches.

FARM IMPLEMENT REMOVES OBNOXIOUS WEED GROWTH

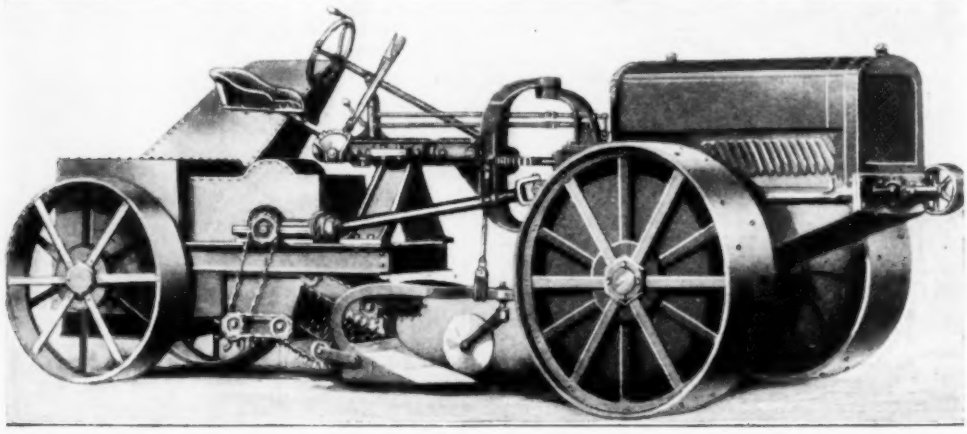
The eradication of weed growth, which would eliminate an annual loss of $300,000,000 to the farmers of this country and make possible the cultivation of 6,400,000 acres of farm land abandoned because of weeds, is promised through a recent invention. The implement is essentially a standard tractor and weed exterminator. The plowed earth is thrown on a pronged endless-belt conveyor by the action of a plowshare with the moldboards removed. The earth is carried into a chamber where all roots and stalks of the weeds are combed out by fingers attached to a series of cylinders. The weeds are deposited in a tight wagon box at the rear of the machine, and the combed dirt returns to the furrow. The tractor can be used for general work by detaching the weed-removing section.

WASHBOARD HAS REMOVABLE RUBBING SURFACE

A Belfast, Ireland, inventor has patented a washboard with a removable rubbing surface. The corrugated-zinc, or other metal, surface may be slipped out through a slot in one of the side-pieces of the frame, and any accumulations of dirt and soap removed. Thus the board can be kept in a clean and sanitary condition at all times. The edges of the surface are turned so as to fit tightly in grooves in the crosspieces.



¶A huge dredge, which will cost about $1,000,000 and require 700 tons of material, is planned for gold recovery on the Cottonwood River, British Columbia.



The Power Shaft from the Tractor Operates the Pronged Endless Belt and Cylinders, Which Remove the Weeds from the Earth Thrown Up by the Plowshare. Removing the Rear End—the Weed Separator—and Substituting a Caster Wheel, Converts the Tractor into a Machine Capable of Handling Any Farm Job

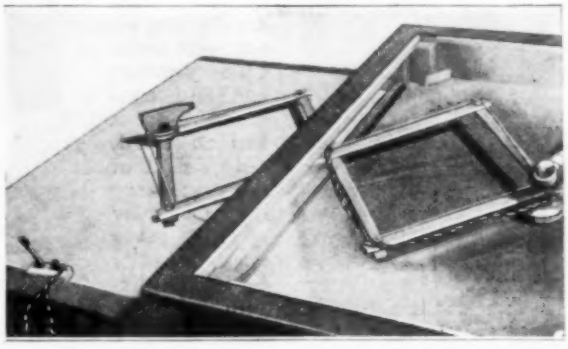
AUTOMATIC OUIJA ANSWERS HEALTH QUESTIONS

This Ouija Board Answers Questions without the Planchette being Touched. It Is Seemingly Automatic and Serves the Purpose of Answering Correctly the Health Questions of the People of Minneapolis

A ouija board that "ouijas" without any apparent manipulation is being used in Minneapolis, Minn., to educate people in health and cleanliness. With this board, the audience simply asks the question of the ouija, and it scurries around to the correct answer, and while it is doing this, hands off, please! It doesn't need help.

It was originally devised by the Hennepin County Tuberculosis Association for use in the city parks to give instruction in the cure and prevention of the white plague. On another occasion it admonished residents of the city to clean up their back yards in the spring clean-up drive.

A pantograph frame and an electromagnet compose the secret of its operation. The planchette, shod with smooth metal shoes, is guided by an electromagnet concealed underneath the board. The latter is attached to one end of the pantograph frame. The operator, concealed from the audience by a wall covered with posters, is provided with a complementary board covered with the same letters, figures, and words as the one in front. A pointer which he moves over this complementary board is secured to the other end of the pantograph. The operator simply moves the pointer to whatever lettering will answer the question on the board visible to the questioner. Whipcord, wrapped around the pointer and following the frame of the pantograph to the magnet, enables the operator to turn and point the planchette to the desired letter or word after it has moved across the board. As the end of the pantograph supporting the magnet moves under the board visible to the spectators, and the other end with the pointer must move over the complementary board, the



A View underneath the Mechanical Ouija: The Pantograph is Moved by a Concealed Operator. It Has an Electromagnet and This Attracts the Metal Feet of the Planchette to Whatever Point Desired by the Operator

operator's board is a few inches lower than the other.

The ouija may also be operated, as was done during the clean-up campaign, by an operator who sees the spectators' board through a peephole. This does away with the necessity for a complementary board, but would be successful only when the spectators cannot get too near the board, as when it is placed in a window.

ICE PRESERVER PREVENTS WASTEFUL MELTING

The wasteful use of ice as a cooling medium is prevented in a simple manner in the design of a new container for ice

The Ice Cake is Placed on the Open Wire Bottom of This Container and the Resultant Cold Air Descends, Driving the Warm Air before It. Insert: The Container Open

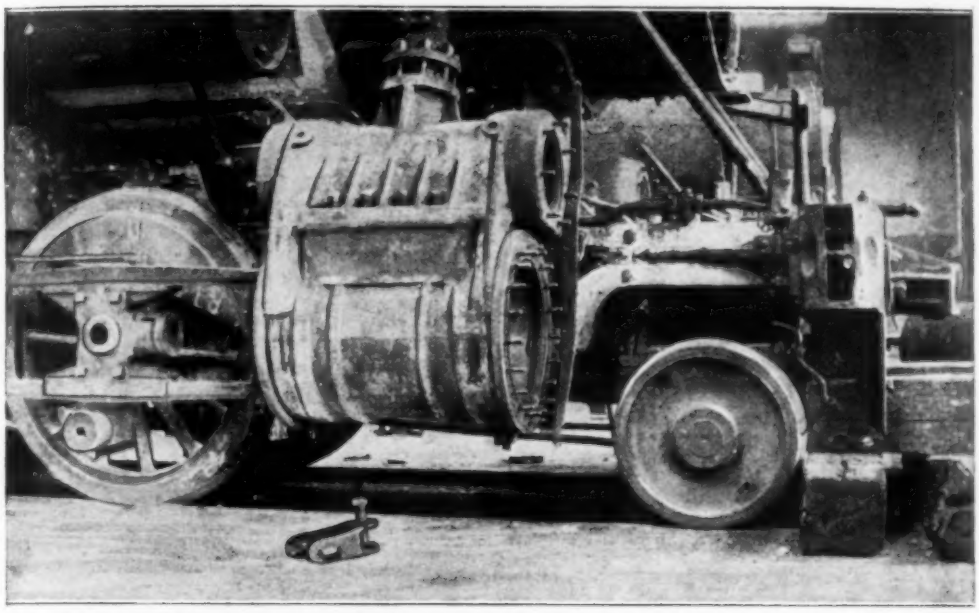
cakes to be placed in the home ice box. In this case the application of the principle results in a distinct economy because of the elimination of unnecessary melting of the ice. The container is a box made of corrugated sheet metal, having a net-wire bottom, and the top and one side hinged. The ice is placed on the wire bottom and the unit put into the refrigerator. The cold air descends, driving the warm air before it. Meanwhile the ice creates a jacket of cold air in the space that separates it from the container, thus retarding melting.

INSECTS IMPORTED AS A BOON PROVE TO BE A BANE

It is possible for the remedy to be worse than the disease. This has been very forcibly demonstrated in citrus-fruit regions in California. Two years ago, a fly of the plant-louse family was brought from Africa for the purpose of eliminating the black scale that had taken for years a toll of millions from the citrus-fruit industries of the state. As hoped for, the scale disappeared entirely, but the fly increased enormously, and is now one of the greatest insect pests there. Its bite is in some cases so serious that sufferers have to go to a hospital. Two insectories conducted by the State Department of Agriculture were temporarily closed, recently, pending the recovery of a dozen employes from the disagreeable bites of these insects. Consequently, now the department is searching frantically for an exterminator of its former friends.

STETHOSCOPE USED TO DETECT FAULTY BEARING CONDITIONS

The engineer, in charge of machinery, can now detect any faulty condition of bearing, whether due to improper lubrication or imperfect parts by means of a telephonic arrangement. The vibrations of the bearing are transmitted to a microphone screwed into the bearing cap and connected to a switchboard. Any defect of the machinery in the vicinity of the bearing can be readily detected by listening at the switchboard receiver, and with a great many bearings, all can be connected to the same switchboard, listened to in turn, and the trouble localized. Stethoscoping an entire ship or factory, formerly done by several men listening through a rod at each bearing, can now be done from one point by one man, requiring only a few seconds for each test.



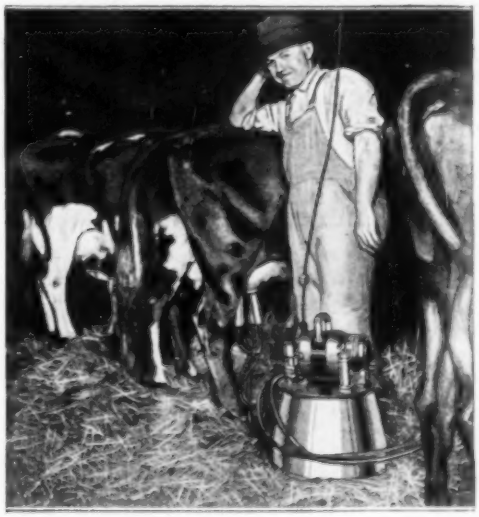
In Order to Take Advantage of Economies Possible with Superheated Steam on Locomotives, This Engine has been Provided with the Necessary Piston Valve in the Place of the Old-Style Slide Valve. Unusual Methods were Applied in Preparing the Engine for the Cylindrical Valve Body

CHANGING A SLIDE-VALVE TO A PISTON-VALVE ENGINE

The ingenuity and resourcefulness exercised by locomotive mechanics and repairmen is exemplified in the conversion of an old slide-valve locomotive to a modern piston-valve driver. The old cylinder saddle was machined off, and the original steam chest replaced with the piston-valve chamber, the new part having been previously fitted to size and then bolted on. Steel bands were shrunk around the ends of the joining parts. All danger of steam leakage was removed by bushing the cylinders. The change was made because of the increased economy and efficiency with superheated steam. The new locomotive is in use on a western railroad.

MILK-CAN LID HOLDS POWER MILKING APPARATUS

A very simple milking apparatus which is in reality a combination of milk-can lid and milker, and which efficiently performs the work of older types of milking devices, is now being marketed. Milk is drawn through tubes from the udder of the cow by vacuum created in the milk can by a motor-operated vacuum pump and pulsator located with the motor on the lid. When the can is full, the power is stopped and the lid is carried to another can by a convenient handle. In case of breakdown, another lid may be had from the manufacturer for use while repairs are being made.

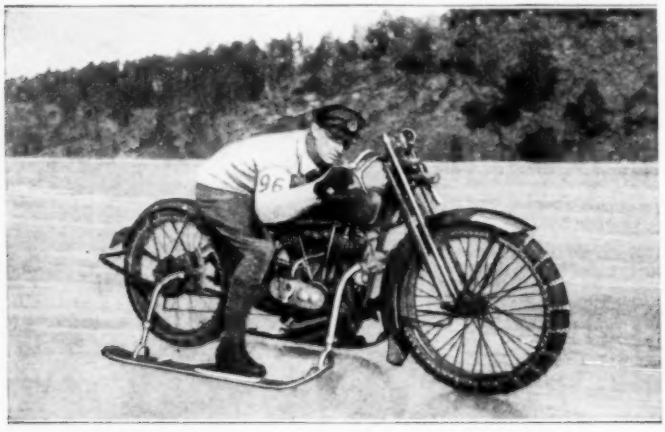


The New Milking Machine Is in Reality a Combination of Can Lid and Milker

¶A bill appropriating $2,000,000 for the construction of a state office building in the city of Chicago, has been passed in the senate of the Illinois legislature.

SKI STABILIZERS FOR ICE-RACING MOTORCYCLES

World-famous as sportsmen on the ice and snow, the Scandinavians do not forsake these beloved elements even for their motorcycle races. American cycles, because of their sturdy construction, are used when equipped with ski stabilizers, to compete in very thrilling ice races throughout Sweden, Norway, and Denmark. Metal tubing, rigidly fixed to the motorcycle frame, holds the skis in place on either side of the rear wheel. One racer whose motorcycle was equipped with the stabilizers, attained the record speed of 72 miles an hour over the ice of a Swedish lake. To increase traction, skid chains are used on the driving wheel of the racing cycles.



The Skis Serve as Stabilizers. An American Cycle, Thus Equipped, has Made 72 Miles an Hour over an Ice-Crusted Swedish Lake

NOVEL SHOE-STORE ENTRANCE IN SHAPE OF SHOE SOLE

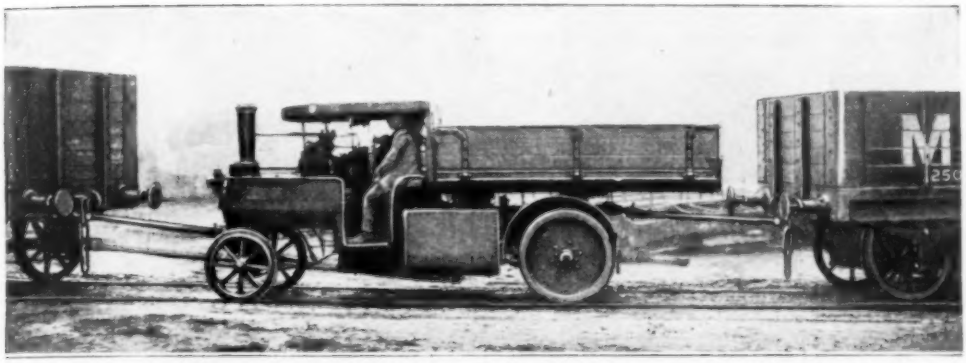
A Georgian's idea for attracting trade to his shoe store, is to fit into his regular entrance a piece of sheet metal in which an opening in the form of a shoe sole and large enough for a man to pass has been cut. To economize and further emphasize his business, he used the metal cut out as a sign to advertise his various departments. The immense shoe facsimile gives a very striking impression on first sight, and a large tourist trade is the result.

The Shape of the Sign Tells This Man's Business. It is Cut from the Metal Making Up the Entrance

GOATS HELP RANCHER TAMP DOWN SILAGE

These Goats are Earning Their Fodder by Packing Down the Silage in the Big Silo in a Thorough and Satisfactory Manner

A rancher in the Southwest, finding it rather difficult properly to pack his silage for preservation, placed a number of goats in the silo while it was being filled. The goats, driven around and around, were at first confused by the stream of silage, but gradually became accustomed to the conditions of their work. After the silo had been filled, the goats were lowered by means of a wide canvas sling.



The Steam Motor Truck, Made in England, and Operating in France as a Railroad Switch Engine: It is Pushing One Unloaded Truck and Pulling Another, All under the Control of One Man on the Driver's Seat. On Top of the Horizontal Boiler Is the Engine with Compound Cylinders

STEAM MOTOR TRUCK SHUNTS TRUCKS ON RAILROAD

Motor trucks, driven by steam, with the appearance of small locomotives, are an unusual type, in this country at least, and a truck of this nature that is also a switch engine on a railroad is probably without precedent. A steam truck made in England is being used in France for this double purpose. The truck has a capacity on the road of three tons, and when used as a switch engine, it can either push or pull two unloaded railway trucks. It resembles a small locomotive, with a horizontal boiler, on top of which is mounted a compound engine, which is connected through a transmission system to a chain drive on the rear axle. One man takes care of the driving, firing, and engine control without any trouble.

ENORMOUS WOOD LATHE BUILT FOR THE U. S. GOVERNMENT

A gigantic wood-turning lathe to be used for cutting ship masts and other long wooden fittings, has been designed and built for the government by an eastern machinery concern. The working bed of the bulky machine is 62 ft. long and is built to swing a piece 32 in. in diameter. Two carriages and two steady rests are provided to furnish support for the longer pieces.

RIDGED-STEEL ARCH SUPPORT BUILT INTO SHOE

The need for some form of support to prevent the breaking down of the arch of the foot, and to keep the weight of the body correctly supported on the ball and heel, has been recognized by orthopedic authorities. The general form of support has been that of a removable piece of metal that fits into the shoe,

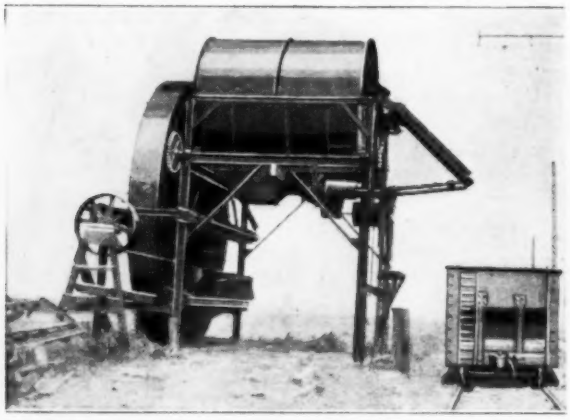
From Left to Right: Phantom View of Arch in Place; X-Ray of Human Foot in a Shoe, Resting on the Arch, and Three Types of Arches

manufacturers confining themselves to the placing of a thin strip of wood, or metal spring, in the instep of the most expensive shoes. Now comes the invention of an inexpensive ribbed cold-rolled-steel arch support that can be fastened in the shoe during manufacture, doing away with the expensive arch support.

Two Steady Rests and Two Carriages Support the Pieces Turned in This Wood Lathe. It Is 62 Feet Long and is Built to Swing a Piece of Material, 32 Inches in Diameter

AUTOMATIC CLEANER AND LOADER FOR SUGAR BEETS

By FRANK B. HOWE



Sugar Beets are Unloaded from a Wagon into a Chute Shown at the Bottom of the Larger Cylinder, Which, Revolving, Carries Them to the Cleaning Drum at the Top

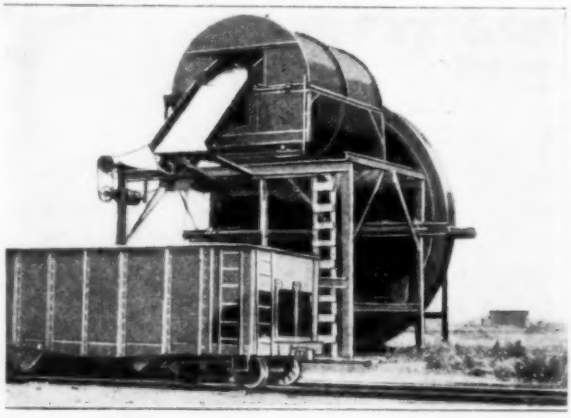
AN electrical machine, devised to clean, convey, sort, and load sugar beets, has been erected by a Pacific-coast railway at one of its sidings.

The machine takes the sugar beets as they come from the field and, without further attention, performs all the above operations. When it is done, nothing remains but to attach the locomotive and haul the loaded cars away.

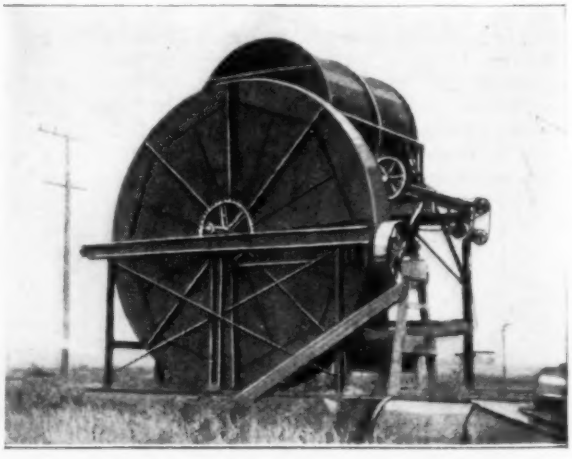
The device, to outward appearance, consists of two cylinders. The larger one, about 15 ft. in diameter, is fitted with a chute at the base and shelves around the inside. The beets are shoveled from the wagon, in which they come from the field, into the chute. The wheel, revolving, carries them to the top on the little shelves, where they fall into the other cylinder. Inside this second cylinder is a smaller slatted one. As the two revolve, the dirt is knocked off the beets by the slats and falls into the outer of the two. The beets go on to the outer end of the slatted cylinder, where there is a chute that loads them into the railroad car, spotted on the track below. When the wagon has finished loading its cargo into the chute, the trap-door at the bottom of the outer of the two upper cylinders is opened, and the dirt that has been removed from the beets falls into the wagon, which hauls it back to the field and disposes of it.

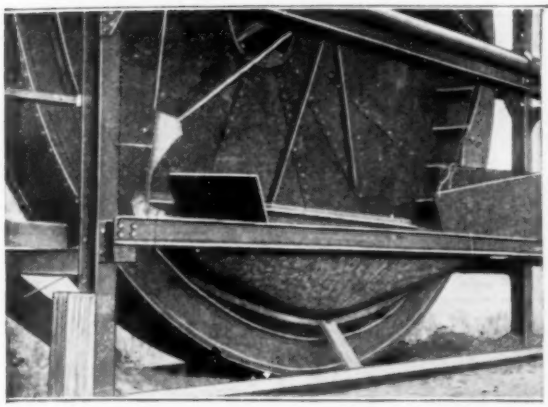
The advantage of such a machine in saving time and labor is apparent, and naturally the railroad employing it has a distinct advantage over competing lines which have no such facilities to offer. Besides, the shipper has no freight bills to pay on dirt that clings to the beets, as when the usual loaders are used.

Makeshift apparatus for beet handling has long been in use, as a casual observance along the Platte River in Ne-



After Cleaning in the Big Drum at the Top, the Beets are Conveyed through a Second Chute Shown at the Mouth of the Upper Cylinder, to a Car for Shipping. Below: Back View Showing the Relative Positions of the Two Cylinders. A Good Idea of the Size of the Larger Wheel may be Obtained by Comparing It with the Telegraph Pole in the Background





Where the Beets Enter the Machine: They are Shoveled into the Trough Which Feeds Them to the Larger Cylinder. Right: Internal View of This Cylinder Showing the Shelves on Which the Beets are Raised to the Cleaning Chamber Above. This Incloses a Third Slatted Cylinder in Which the Beets are Tumbled About to Free Them from Dirt

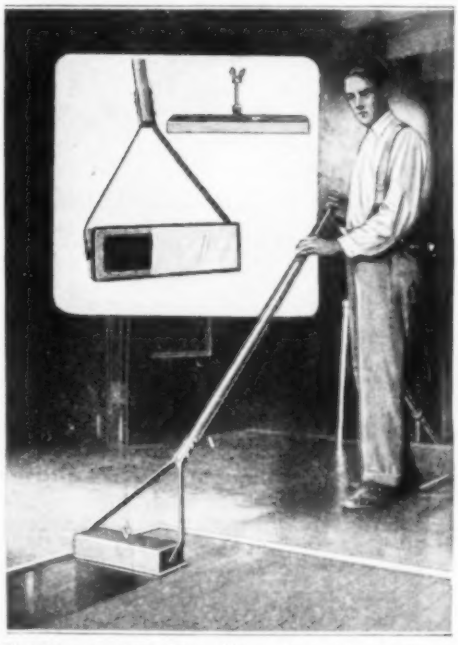
braska would disclose. Improvised trestles and loading platforms dot the railroad rights of way throughout almost the entire state. With the introduction of the new device in such a territory, much more may be expected of the industry.

CHINESE COAL SHIPPED TO THE UNITED STATES

The first shipment of Chinese coal ever to reach the United States is to be the forerunner of a steady stream of Far Eastern coal, should the fuel find a ready market. The initial shipment, invoiced at $9 per ton, is part of a total shipment of 140,000 tons of Manchurian coal to be made by a Japanese concern. Although no exact survey has been made, reports indicate that there are vast undeveloped beds of coal in Manchuria.

FLOOR WAXER ELIMINATES BACK-BREAKING OPERATION

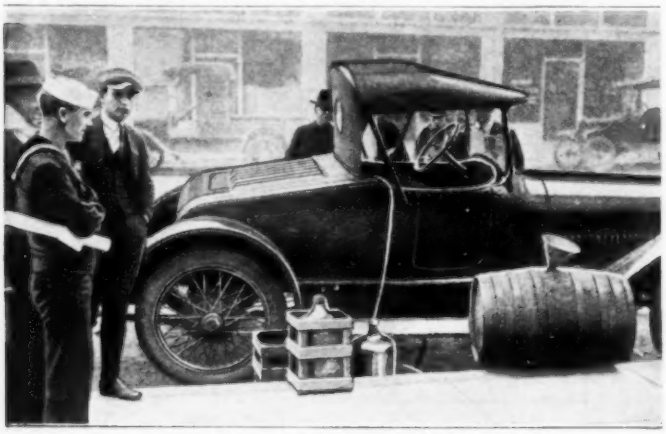
Instead of spending long hours on hands and knees getting hardwood floors properly waxed, one can do the work in a few minutes standing upright with a small carpet-sweeperlike tool, very simple in construction and operation. The wax, in the bottom of a hardwood box, is forced through a cloth, on the underside of the box, by the pressure of a block of wood held down against the wax by a coiled spring. The wax flow can be regulated by a thumbscrew working against the spring on a bolt, one end of which is fastened to the forcing block, while the other end passes through the top of the box. The handle and braces, about five feet long, are fastened to the box so as to permit a free movement.



The Wax for This Floor Waxer Is inside the Box and is Forced Out through a Cloth by a Spring. Insert: Underside of Waxer with Cloth Drawn Back, and Thumbscrew and Block That Force the Wax Out

EIGHTY-GALLON WHISKY TANK IN AUTOMOBILE

In the detention of a high-powered roadster recently by district officers attempting to enforce the provisions of the Volstead act, there was effected quite the largest haul of its kind so far made in San Diego, Calif. The back of the car was equipped with an 80-gal. tank, holding at the time of capture 70 gal. of whisky, which was, according to official experts, a very fair grade of bourbon. The container was so skillfully built in that it is said the lay observer would have suspected nothing more than the ordinary tool box.



This Roadster was Found Fitted with an 80-Gallon Tank, Nearly Filled with Whisky, When Detained by Suspicious Prohibition Officers. The Illegal Load was Siphoned into Jugs and Kegs for Safekeeping

HUNTERS SHOULD REPORT FINDING BANDED BIRDS

Hunters, or other persons engaged in outdoor activities, should report the finding of marked birds. The markings referred to are bands about their legs which have been placed there by the Bureau of Biological Survey, U. S. Department of Agriculture. These bands indicate that certain research work is being done with that bird by the bureau mentioned. If the bird found is dead, the band should be removed and returned to the department. If alive, the number only should be noted and reported, leaving the band intact.

¶A photographic portrait, measuring 5½ ft. by 7½ ft., the largest in the world, was recently taken of a motion-picture star, to be used as special advertising. The head only is shown.

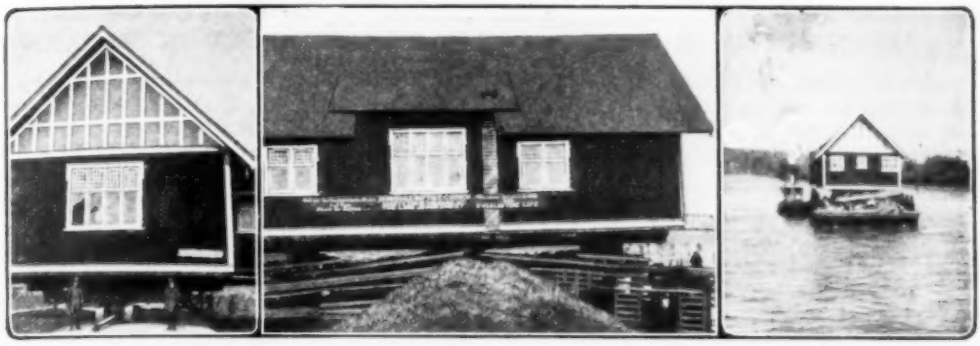
WORLD-WAR FIELDS WILL BE MARKED BY RELIEF MAPS

Relief maps representative of the topography and historical features of the great world-war battlefields, which are to be used as permanent markers on those fields, are planned by a commission organized in this country. The maps will take in certain stipulated areas and will be simply constructed to help the visiting public to understand them. Bronze or porcelain has been decided upon as the material for the maps. Each will be mounted on a suitable pedestal and fitted with a bronze plate bearing data as to the organizations that fought on the territory represented. All of the battle lines will be shown historically correct, as the marker maps will be worked out from the original battle maps of General Pershing.

TIN RING ON COCONUT PALMS FOILS RATS AND LAND CRABS

Around the Hawaiian and other South Sea islands where coconuts are the main article of commerce, the crop must be carefully protected against the inroads of rats and land crabs. These pests climb the trunk and injure the nuts. Most of the trees are now being wrapped with a band of tin on whose smooth surface the marauder obtains no foothold.

A Tin Band, About Halfway up the Coconut Trees, Allows Rats and Land Crabs No Foothold for Climbing, and Prevents Them from Reaching the Nuts



A Building Donated to the Baptists of Kerrisdale, British Columbia, had to be Moved 30 Miles to Its Foundation. Left: Jacked Up for the Trip. Middle: Crossing a 12-Foot Dyke. Right: By Water down the Pitt and Fraser Rivers to Its Resting Place. The Trip was Made without Accident or Damage

BAPTIST BUILDING MOVED THIRTY MILES BY WATER

Blessed with the will to win and the donation of a new building which was about 30 miles from their city, the Baptists of Kerrisdale, B. C., performed a great work in building moving until their new structure rested on the site they had selected for it. A ditch, 40 ft. wide, and a dyke, 12 ft. high, were two of the obstacles encountered which failed to stop the moving. The building was next loaded on a barge and towed down the Pitt River to the Fraser, where the course changed, and on the latter stream it then traveled until Kerrisdale was reached. After another 2½-mile haul, the building was finally unloaded. Not a window was broken, not a patch of plaster out, nor was the building otherwise damaged.

COMPASS OF VISION ENHANCED BY OPERA-GLASS SPECTACLES

Certainly no more of a disfigurement than the modern horn-rimmed spectacles, and infinitely more effective as a means of seeing any kind of a show, is a pair of spectacles in which the ordinary lenses are replaced by the telescopic parts of an opera glass. These are focused independently, so that any difference in the eyes of the wearer can be taken care of. They are mounted in a frame that hooks over the ears just like any ordinary spectacles. They are so small and light that they are unnoticeable to the wearer when once absorbed by the charm of such an improvement of the ordinary means of vision.

DEVICE USES LIGHT CIRCUIT TO CHARGE AUTO BATTERY

Generators on motor cars quite often do not keep the battery supplied with the proper amount of current, and to maintain the efficiency of the battery at all times, a charging device for use in the home garage has been developed. It comprises an incased step-down transformer and rectifying-valve combination, which operates from an ordinary light circuit by connection to the bulb socket. The battery connection terminates in a dash socket into which the plug from the charger is placed. Current flowing from the charger overnight is sufficient to charge an ordinary 6 or 12-volt battery at the small cost of 4 or 5 cents.

The New Battery Charger Works on an Ordinary Light Circuit and will Charge a Battery Overnight. Above: Charger. Below: Attaching It to Battery Terminal on Dash

COMBINATION STAND AND SEAT NEATLY HOUSES PHONE

The telephone has inspired the design of more than one piece of furniture within the last few years. The latest addition, either for milady's boudoir or any other

The Telephone Fits into the Little Cabinet, Handy for the User and Away from Sight and Harm. A Telephone Directory may be Attached to the Door

room of the home, is an attractive combination of telephone seat, stand, and cabinet. When placed in the cabinet, the telephone is not only away from the reach of the children and protected from dirt and dust, but also out of sight, which seems to be the object of most devices of telephone camouflage. The stand is particularly convenient for hall use.

ALCOHOL DISPLACES GASOLINE AS MOTOR FUEL IN HAVANA

Alcohol, made from sugar, one of the staple products of Cuba, is being used quite extensively in Havana for driving light motor cars, and to some extent even in large cars and trucks. The alcohol is distilled from sugar molasses, and is denatured, making it undrinkable. Gasoline in Havana costs 50 cents a gallon, and the alcohol is now being sold for 35 cents, with the intention of later on reducing it to 25 cents, so that there is a considerable saving. To adapt it to the use of alcohol, some slight changes are necessary in the carburetor of the ordinary motor, but automobile owners soon learn to use the new fuel, and so the utilization of it is constantly increasing.

IMMENSE DREDGING PROJECT OF NEWARK BAY

For the purpose of establishing a port for ocean-going vessels which will be second to none in the country, the city of Newark, N. J., is dredging Newark Bay from Port Newark on the south side to Kill von Kull, 11 miles away. Realizing that shippers to the congested port of New York will soon have to look elsewhere for additional docking facilities, officials of Newark intend to be on hand with the needed wharves. A 30-ft. channel is being dug. One of the primary objects is to allow the immense ocean-going vessels which are built in Newark to pass readily through the bay. The shipbuilding industry, which is an important one in Newark, grew by leaps and bounds during the war. On the reclaimed marsh lands were located the vast government quartermaster stores. Ships were con-

View of Dredge and the 30-Inch Pipe Line, Supported on Pontoons, Which Stretches from the Point of Work to the Ocean-Going Vessels is being Dredged in the Bay from Newark South to Kill von Kull, 11 Miles Dis Overflow of Ships from Congested New York Harbor. The Dredged Matter is Conveyed through

structed on the fabricated-parts principle; that is, from a master pattern, were cut the structural steel and plates which entered into the construction of the vessels. At present there are 32 ocean freighters tied up at the yards. The dirt from the bottom of the bay is being excavated by a combination knife and suction method. At the end of a long arm, mounted on the dredge and lowered into the water, is a revolving knife-blade apparatus which cuts through the bottom of the bay and loosens the sediment so that it is sucked up through large pipes. From the dredge the dirt is forced by hydraulic pressure through 30-in. mains mounted on pontoons to the shore, a mile and a quarter away. Incidentally the excavated material is used as a filler for waste meadow lands, reclaiming 330 acres of shore line in this manner. So far $1,500,000 has been spent on the project, and the work will be continued until the two ports of New York and Newark are connected by a deep channel.

MILL WILL MAKE NEWSPRINT OF CHICAGO'S WASTE PAPER

So enormous is Chicago's waste-paper supply, that a double-unit, $2,000,000 paper mill which will use it for making newsprint, has been planned. The estimated capacity of the plant will be from 10,000 to 15,000 tons annually. Contracts have been made between large waste-paper collecting agencies and the new concern for the supply.

¶A Canadian banking institution will open a branch for the MacKenzie district at Fort Smith. This point is in latitude 60° north, and will require pioneering ability on the part of the banker.

OIL-INSULATED TRANSFORMERS PLACED IN CONCRETE VATS

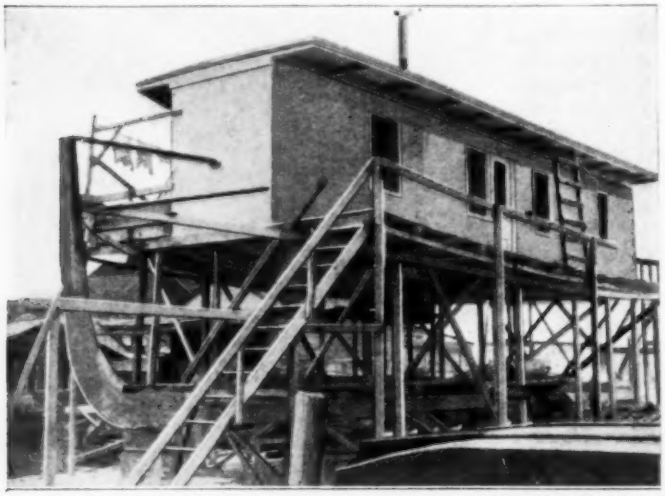
To overcome the spreading of fire through burning oil, when overheated oil is drawn off the oil-insulated transformer, an Oregon power company sets its transformers in concrete vats. These are large enough to hold all the oil contained in the transformer, and are further safeguarded with a sewer drain to carry off any overflow that may occur. The vat arrangement also permits water to be sprayed on the transformers to cool them off.

These Oil-Insulated Transformers are Set Up in a Concrete Vat to Prevent the Spreading of Fire to Wooden Structures from Burning Oil

Shore, One and a Quarter Miles Away: The Outfit is Used at Newark, New Jersey, Where a 30-Foot Channel for tant, in Connection with the Establishment of Increased Docking Facilities to Take Care of the Expected the Long Pipe Line by Hydraulic Pressure to the Shore and Used to Fill In Waste Meadow Lands

THE HOUSE OF A HOUSEBOAT BEATS RENT PROFITEERING

In an endeavor to beat the profiteer-landlord, an ejected tenant of a flat in the Bronx has built himself a houseboat, beginning with the house, and leaving the boat for future negotiation. The result is a neat little three-room frame bungalow, supported by scaffolding, so that it looks like a house on stilts. The bow and the keel of the boat are laid beneath it, and the hull and the deck to support the house will be completed later. In the meantime, the tenant pays what is equivalent to a rent of only $12 a month.



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An Ejected New York Tenant Started to Build a Houseboat to "Beat" Excessive Rent Demands, but after Having Finished the Three-Room Deckhouse, He Left the Completion of the Boat for the Future

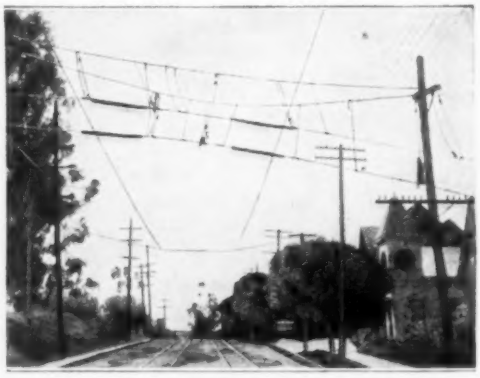
POLICEMEN HARRIED BY TEAR GAS FAIL TO WIELD CLUBS

In an experiment with tear gas as a queller of rioting mobs, 250 select members of the New York police force, who composed the riot battalion, were rendered helpless. At a signal from commanding officers, two grenades containing the gas, were opened. Meanwhile, the squadron was directed to move forward in battle formation. The men were all overseas war veterans and many were skeptical as to the effect of the gas, believing that it would not accomplish the purpose desired. With the gas onslaught, however, they changed their minds, for instead of following the command to move forward, the battalion dispersed in utter confusion. The gas will be used, because of its effectiveness, to disperse mobs in the future.

SINGLE ENGINE PUMPS OIL FROM MANY WELLS

When the recent great demand for oil caused the reopening of a number of abandoned wells in the residence districts of Los Angeles, certain restrictions had to be placed on their operation to avoid annoyance to householders. Since the working of many gasoline engines in a small area would be particularly offensive, a method commonly used in eastern oil districts for making one engine operate several pumps, even though some distance apart, was employed

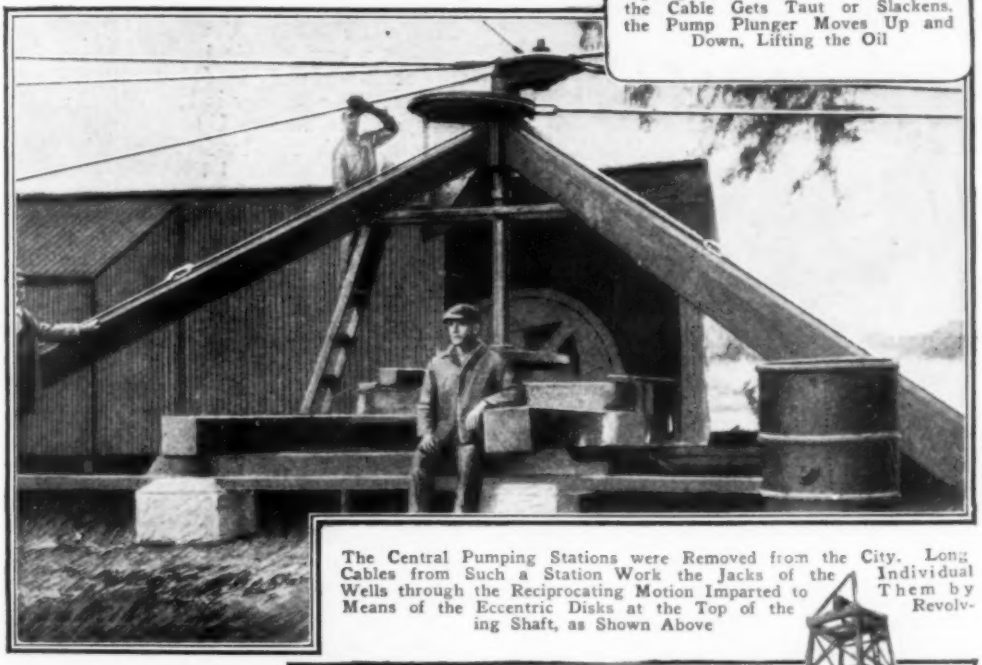
Each oil-well pump is provided with a jack built of heavy timbers, carrying a bell crank at the top. The engine, at a central point, operates a vertical shaft, carrying one or more eccentric disks at the top, to which the cables from the pump cranks are attached. These cables come in from all directions. Some of them are more than a city block in length, and are guided around corners by rings fastened to trees or poles, dodging derricks and other obstacles in their path, and even crossing



The Central Pumping-Station Cables had to Cross City Streets. This View Shows the Method Used in Carrying Them over Trolley Wires

In Looking West on Temple Street in Los Angeles, the Sky Line Looks Like This. A Veritable Forest of Oil Derricks Comes into View. Their Noise Became a Pest to the People, and an Ordinance was Passed, Which Tabooed Their Operation for a While

The Cable from the Central Station is Shown Here Attached to the Pumping-Rig Bell Crank, or "Jack." As the Cable Gets Taut or Slackens, the Pump Plunger Moves Up and Down, Lifting the Oil



The Central Pumping Stations were Removed from the City. Long Cables from Such a Station Work the Jacks of the Individual Wells through the Reciprocating Motion Imparted to Them by Means of the Eccentric Disks at the Top of the Revolving Shaft, as Shown Above

A Producing Oil Well on West Temple Street: This Strangely Located Well Is Not More than 20 Feet from a Three-Story Building. Wells Close to Residence and Business Places, Similar to This One, Were Responsible for City Action against the Oil-Well Operations. There Are Flats and Stores in the Building. Under Former Conditions, the Tenants were Continually Annoyed by the Pump Noise

street-car lines by flexible suspension above the trolley wire. Thus from three to ten separate pumps are operated continuously by the distant engine, with only a moderate amount of noise and confusion.

JAP ON TRIP WITH DOG TEAM SHOWS WONDERFUL ENDURANCE

In a round-trip sledge journey from Norman, Ont., to McMurray, Alta., Canada, a Japanese and his team of four

After a Bitter Cold Trip of 2,400 Miles over Unbroken Country between Norman, Ontario, and McMurray, Alberta, This Japanese and His Husky Dogs Came through Unhurt

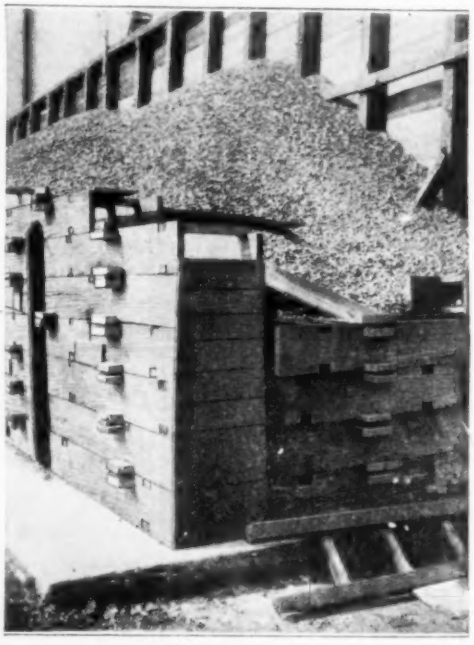
husky dogs have shown remarkable endurance. During almost the whole of the 2,400-mile journey, the weather was bitterly cold. The country was unbroken wilderness, requiring many river crossings and other similar hardships, yet none of the dogs was lost, and the Jap appeared none the worse for wear after the arduous trip.

REINFORCED-CONCRETE GRANDSTAND REPLACES STEEL

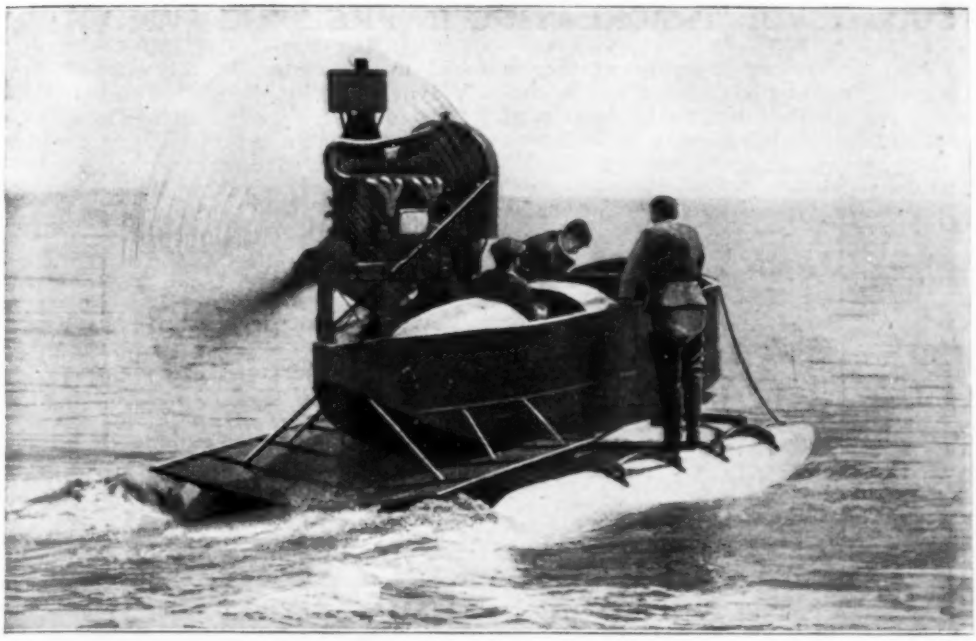
A design which eliminated the rows of pillars supporting the upper ranges of seats, and which had obstructed the sight of the occupants of the lower ranges, determined the authorities of the famous race course at Longchamps, France, to use reinforced concrete for the reconstruction of a section of the grandstand. The original stand design was that of a steel framework covered with stucco, but this was abandoned. The upper ranges of seats are now supported by a huge cantilever, projecting 291½ ft. from the line of supports, and 262½ ft. long. The entire new structure rests upon a reinforced-concrete raft foundation because of the swampy condition of the soil. From this raft rise the four staircase towers and two lines of pillars which support the superstructure.

SECTIONAL HOLLOW TIMBER WALL SUPPORTS COAL PILE

Sections built from two pieces of 1½-in. lumber and placed one upon another to form a hollow wall, will, it is claimed, support a coal pile in better fashion than the ordinary wall made of one piece of lumber. The lumber is 1 ft. wide by 16 ft. long and is fastened together, top and bottom, with two-by-fours notched into the sides. A notch, 1 by 5 in., is cut for the stringers which run back into the coal pile. These are held to the outside wall by nailing 1½-in. pieces at top and bottom. Coal can be dumped into the hollow wall, which increases its stability.



These Hollow Sections are Placed One upon the Other to Form a Wall to Support the Coal Pile. The Sections are Prevented from Sliding by the Stringers Extending into the Coal Pile and Nailed with Two Cleats



Capable of Carrying Seven Passengers and the Crew at a Speed of 60 Miles an Hour, This New Water Glider will Give the Sportsman All the Thrill He can Desire. It is Driven by an Airplane Propeller and the Combination of Pontoon and Sled Gives It a Graceful Gliding Movement over the Water

"HYDRO-GLIDER" THRILLS OCEAN JOY-RIDERS

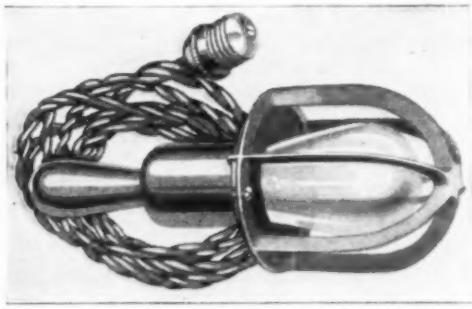
A new "hydro-glider" has just been completed on the west coast which is said to furnish all the thrill and speed of a hydroplane gliding over the surface of the ocean. In fact it amounts practically to a flying boat without wings. A boatlike form is mounted on a couple of pontoons and is driven over the surface of the water by a 190-hp. air-propeller motor at a speed of 60 miles an hour. A broad under sledge furnishes additional gliding surface when the craft is hitting the waves.

MINERAL DEPOSIT IN NEVADA USED FOR MAKING SOAP

A mineral deposit composed of alumina, silica, potash, and borax is being mined in Nevada, and transported to a plant in a neighboring town, where it is manufactured into toilet and laundry soaps, and pastes of various kinds for cleaning purposes. The ore is mined with pick and shovel, and when it reaches the factory, is ground and mixed with coconut oil. This curious deposit has long been known to the Indians of the district, who used it for curing saddle sores on their ponies.

NEW-TYPE PORTABLE LAMP IS COMPLETELY PROTECTED

A new portable lamp, placed on the market by an eastern manufacturer, is designed to provide maximum of light, complete protection against breaking, ease of wiring, and lightness in weight. The casing, of a special aluminum alloy, fits entirely around the socket and flares out into a flange at about the base of the filaments. The cage guard fastens to this



The Socket of This Portable Lamp is Inclosed in an Aluminum-Alloy Shield. The Cage Guard, Attached to the Shield and of the Same Metal, Completes the Protection

flange. A separable handle is fastened directly to the threaded stem of the socket, simplifying the wiring.

SUCCESSFUL TRACKLAYING IN FREEZING WEATHER

Street tracklaying in frosty weather is generally considered impracticable, because the roadbed has to be largely of concrete, which is ruined if it is frozen while setting. Nevertheless, a double track, seven blocks long, was successfully laid in midwinter, in the city of Fort Wayne, Ind., by the utilization of quantities of straw and manure, which are good nonconductors, especially the latter. The new double track replaced an old single track, which, to begin with, had to be torn up, and yet, including this operation, the whole undertaking was completed in the brief period of three weeks.

After completion of the track, the road had to be repaved, also a difficult job in frosty weather. As prices go, nowadays, the cost of $50,000 was moderate. The credit for this performance is due to the Indiana Service Corporation which operates the street-car lines in Fort Wayne.

Above: The Old Track has been Torn Up, and the New Concrete Base for the Double Track is Completed. Some of the Straw That was Used to Keep Out Frost can be Seen beside the Roadbed. Right: The Ties have been Laid, and Are Ready for the Rails. Below: The Track is Completed, Ready for the Paving That will Make It Flush with the Rest of the Street

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¶Radium has been found in Congo. Rumors were rife for a year that rich radium minerals were in the district. The Geological Society of Brussels now announces the discovery to be a fact. Belgian colonists have sold specimens in London.

NEW DESIGN OF MACHINE FOR COOKING DOUGHNUTS

After several years of experimentation, a western concern has developed a machine which produces 29 doughnuts per minute, by means of a novel air-controlled apparatus, and a heating unit which may be operated on either gas, coal oil, or electricity. A small air pump insures circulation of the hot grease which cooks the doughnuts. In operation, the dough is placed in a cylindrical container above the center of the machine. Air pressure expels rings of dough through the bottom of this holder, cutting them properly. This stream of dough rings falls into a spiral channel filled with hot grease which is maintained in circulation so that the flow of doughnuts is directed counterclockwise toward the delivery table. An ingenious finger arrangement in the middle of the spiral course turns over each doughnut as it passes. In this manner the doughnuts are nicely browned on both sides when they are finally delivered to the apron which carries them to wire baskets at the end.

Air Pressure Drives Rings of Dough Out of the Upper Container. They Pass through the Grease-Filled Spiral Channel Below for Frying

GRAVITY SCREENING PERMITTED BY LOCATION OF GRAVEL BED

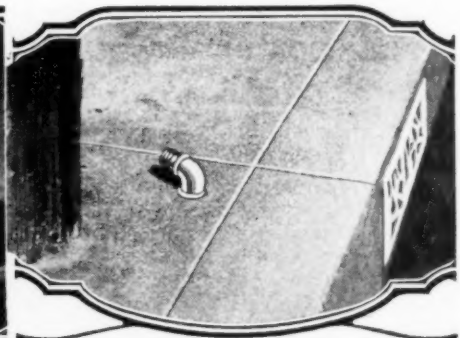
The location of a bed of high-grade river-bottom gravel on the top of a hill in western Colorado, led to the building of a chute and screen which transports the gravel to trucks in the road below, after grading the material into sand, gravel, and stones. The material is fed into the top of the chute, constructed of heavy planking and lined with sheet steel, with a scraper drawn by two horses. The screen, near the bottom of the chute, grades the fine sand and gravel into separate bins, and discards the large rocks.

Trucks Load Up with Gravel and Sand from Under the Near End of the Chute Trestle. The Material is Poured into the Chute from the Top of the Hill and Screened into the Bins at the Lower End of the Chute

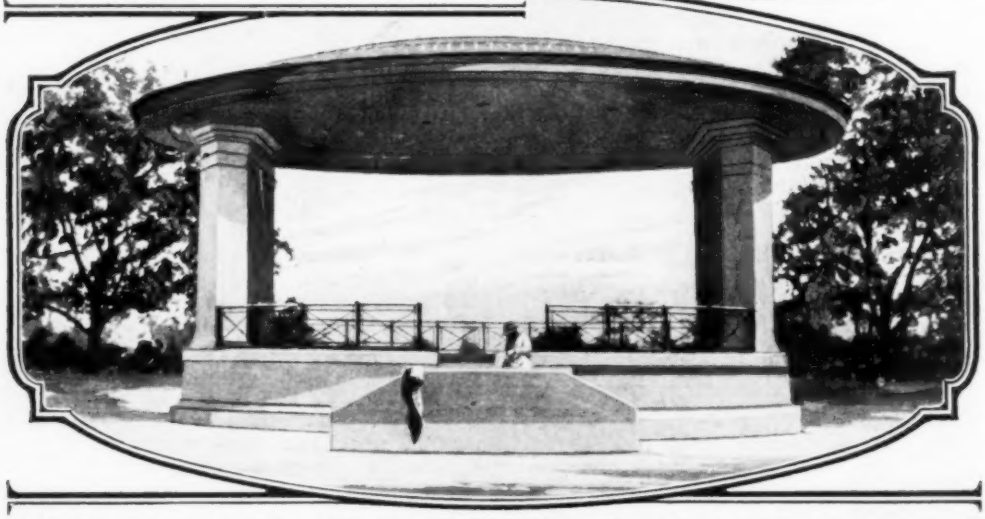
NEW BRITISH FLYING BOATS HAVE WIDE CRUISING RANGE

As is well known, the British government has practically decided to abandon the construction of lighter-than-air flying machines. There is a reason. Recent developments in heavier-than-air machines demonstrate their superiority, and indicate remarkable possibilities. As a commencement in this direction the British Air Force is now building large machines of the flying-boat type. The first machine completed has a wing span of 140 ft. Its hull is almost circular in cross section, being very light and strong, with a resiliency that yields to the blow of a wave in a choppy sea. In this are mounted five machine guns, and there are sleeping and working accommodations for a crew of seven men. Its cruising range is 1,500 miles, and its air speed 110 miles an hour.

This Old Indian Mortar and Pestle are Imbedded in the Post-Office Wall of Quincy, California, the Center of the '49 Gold-Rush Country. The Rocks below and above the Mortar and Pestle Are Gold-Bearing Ore Dug in That Year



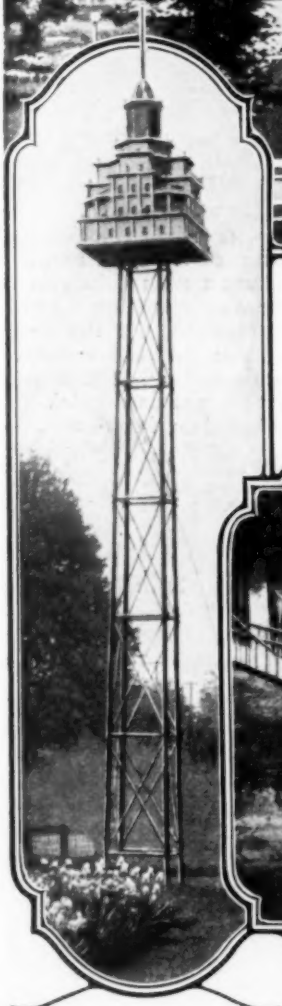
The Sidewalks of San Diego, California, are Equipped, at Intervals, with Hose Connections Placed near the Curbs, for the Convenience of Property Owners in Sprinkling the Sidewalk or Lawn



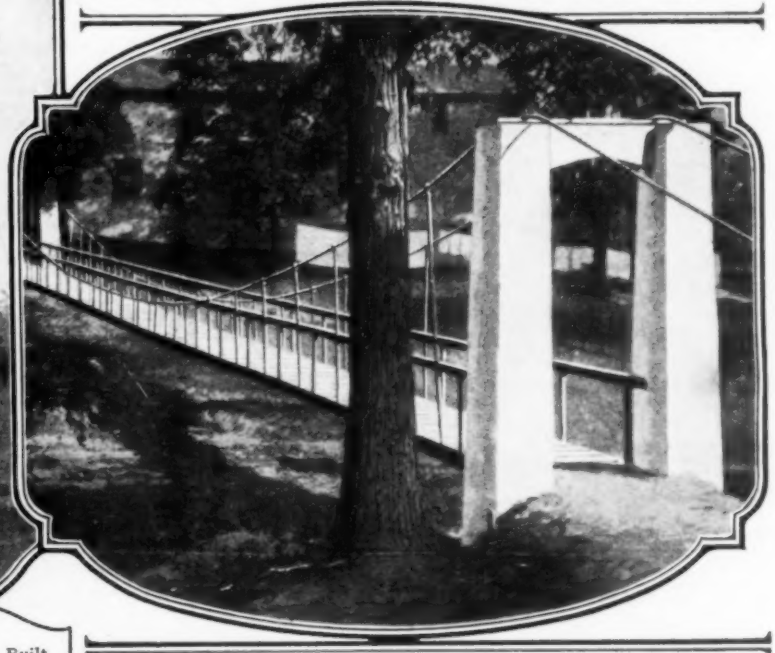
Steel and Concrete Bandstand Erected in a New Orleans Park as a Memorial to the Parents of the Donor: It Measures 26 Feet in Diameter and Has a Base Four Feet High. The Roof, of Copper, Gives a Clear Height of 16 Feet from Floor to Ceiling. Ornate Carvings Decorate the Massive Sides Which Support the Roof Structure

McGregor, Iowa, has Built Its Main Street to Carry the Water Which Comes down the Hills, into the Pocket Where the City Stands. Formerly an Extra-Heavy Rainstorm would Flood the Town, Causing Damage to Business and Homes. Now Main Street has been Dug Down Considerably and Smoothly Paved, and the Flood Water Rushes over the Pavement Down to the River

A New Penitentiary at Baton Rouge, Louisiana, was Built outside the City Limits, So the Old Building was Razed, and the Grounds Utilized for a Park and Community Center. Besides the Usual Arrangement of Flower Beds, There Is a Spacious Community Club, a Large and Well-Equipped Swimming Pool, a Wading Pool for the Children, and a Dancing Pavilion. It is to Be a Memorial to the Overseas Heroes of Baton Rouge



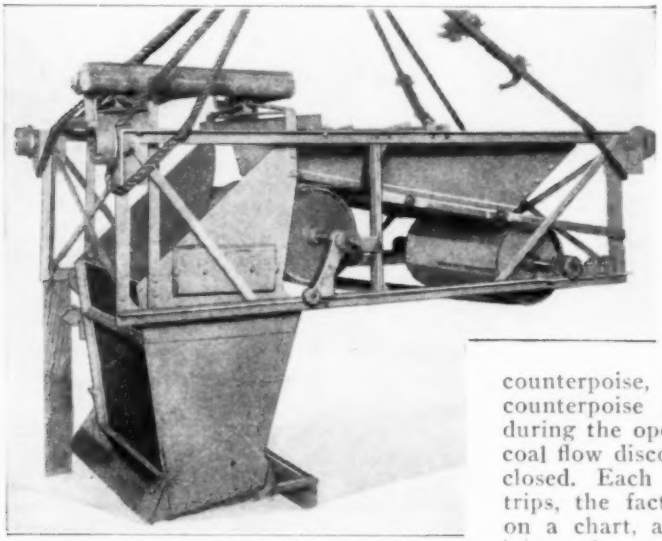
St. Thomas, Canada, Built Three Bird Houses Like the Above to House the Blue Martins That Make the City Their Residence during the Summer Months. The Houses are Located in the Parks and Each Accommodates 80 Pairs of Birds



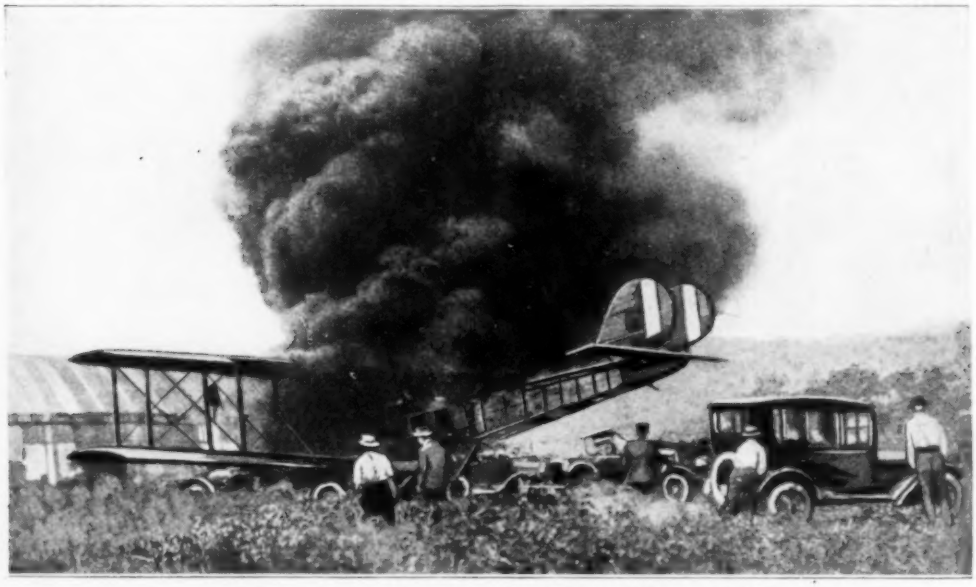
A Small Ravine near Winchester, Kentucky, is Spanned by This Pleasant Substantial-Appearing Suspension Bridge. The Cables, at Each End, Pass over Two Whitened Concrete Piers Connected at the Top by an Arch to Form a Neat Gateway. The Bridge is Constructed on the Same Principle as the Larger Suspension Bridges and does Not Clash with the Surrounding Scenery. It is Used Exclusively for Foot Traffic

AUTOMATIC COAL SCALE CHECKS FUEL CONSUMPTION

The condition of a boiler can best be determined by the results it produces on the amount of fuel it consumes, and to gauge this consumption a new automatic coal scale has been developed. It is to be located between the coal bunkers and the coal-delivery pipe to the boiler stoker grate, and comprises a set of two hoppers connected by a conveyor belt. The coal enters the upper hopper and is conveyed to a second, or weighing, hopper by the belt. When the latter hopper has a 200-lb. load, it trips by overcoming the weight of a counterpoise, and drops its load. The counterpoise stops the belt mechanism during the operation of tripping, and the coal flow discontinues until the hopper is closed. Each time the weighing hopper trips, the fact is recorded by the scale on a chart, and from this the engineer knows the coal consumption. Other features, which assist in making quick repairs, are also included in the device.

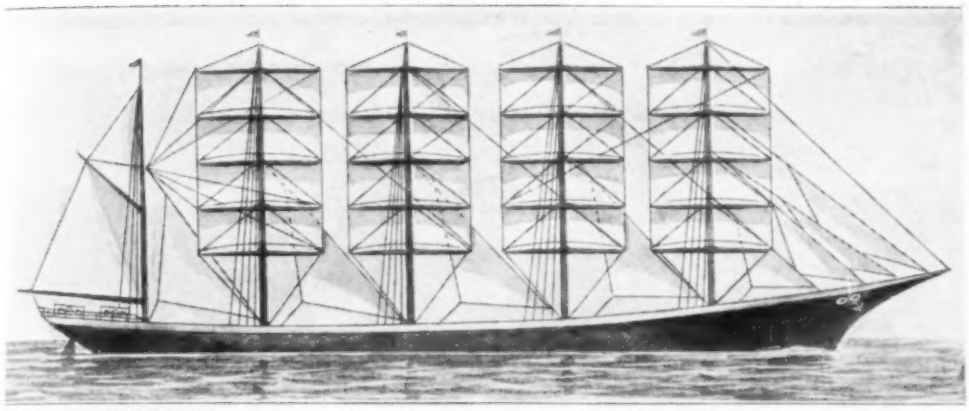


The Upper Hopper of This Coal Scale Receives the Coal from the Bunkers and Passes It to the Lower, or Weighing, Hopper. This Empties and Records at 200 Pounds



AIRPLANE FALLS AND EXPLOSION KILLS FIVE

SCARCELY 300 yd. from the take-off at Moundsville, W. Va., a large Martin bombing plane on a flight from Dayton, Ohio, to Washington, D. C., suddenly tilted, and then shot downward. Landing among a group of about 20 automobiles, one of its three gas tanks exploded with terrific force. But for the fact that several minutes elapsed between the time of the explosion and the spreading of the flames, which stopped rescue work, the loss —5 killed, 14 wounded, and 14 cars destroyed—would have been greater. The first explosion was followed by others, when the remaining two airplane tanks and several of the automobile tanks were ignited. The picture shows the burning plane and some of the automobiles.



BY COURTESY OF THE MARINE JOURNAL

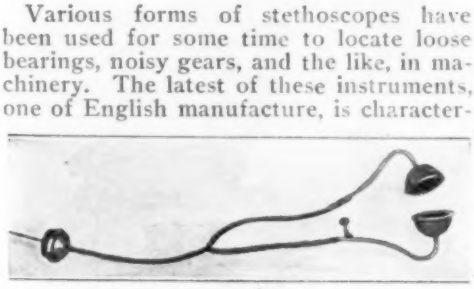
Novel Design of Rigging for Sailing Vessel: All the Square Sails Are of Equal Size, and the Yards of Equal Length. The Fifth Mast Astern Has a Spanker and a Topsail. At the Bow Are the Usual Jibsail and Flying Jibs. Between the Masts Are Other Sails

SQUARE-RIGGED SHIP DESIGN HAS MANY NOVEL FEATURES

A type of sailing vessel that is extremely original, in connection particularly with its sails and rigging, has many advantages claimed for it by the designer of the first steel sailing ship that was built in this country. As regards its sail design it consists predominantly of square canvas on yards all of equal length. Of this type of sail it has four on each of four masts. A fifth mast in the stern carries a spanker and a topsail, while at the bow there are the familiar jibsail and flying jibs. There is therefore an entire absence of anything in the nature of a skysail, and there are also no halyards. The ship would be provided with limited auxiliary power in the form of a small oil motor and one feathering propeller to give a speed of six or seven miles an hour—sufficient for harbor use, or for crossing doldrums.

NEW MACHINERY STETHOSCOPE LOCATES FAULTY PARTS

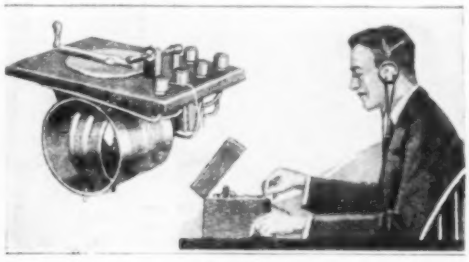
Various forms of stethoscopes have been used for some time to locate loose bearings, noisy gears, and the like, in machinery. The latest of these instruments, one of English manufacture, is characterized by valves in the tubes leading from the listening diaphragms to the ear tubes. By means of these the sounds emitted by suspected parts can be compared with those from parts that are known to be in proper working order. For instance, when two or more ball bearings are mounted on a short shaft, it is quite often difficult or impossible to locate the noisy one without dismantling the entire mechanism. In such a case the new device should prove quite valuable.



Stethoscope for Locating, by Listening through It, Loose Bearings, Faulty Gears, and the Like, in Machinery

COMPLETE RADIO-RECEIVING SET WEIGHS FIVE POUNDS

The latest development in radio receivers is a complete outfit that weighs but

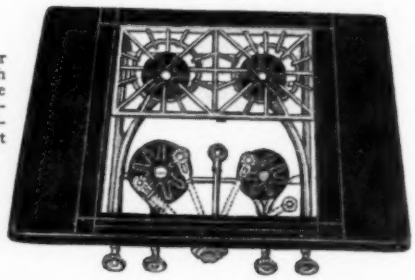


The Picture to the Left Shows in Detail the Baby Radio-Receiving Outfit. It Packs into the Small Case Seen in Front of the Operator

5 lb., and requires only a connection to a ground and to a single-wire aerial for operation. The set includes a variable tuner, a fixed condenser, a supersensitive crystal detector, and a high-grade set of head phones. An indicating arm operating over a graduated dial permits quick and accurate tuning to wave lengths within a range of 190 to 500 meters. The apparatus fits into a neat case.

SOME NOVEL AND LITTLE-KNOWN ACCESSORIES

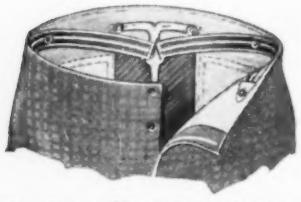
A Foldable Paper Shopping Bag with Metal Eyelets Where the Cords are Threaded: It is Made in Different Convenient Sizes



Shifting of Heavy Cooking Utensils is Minimized by the Swinging Simmering Burner. It Lights All Burners from One

Twelve Streams of Liquid and Gas Flow from This Fire Extinguisher When Its Cap is Jerked Off

All the Heat from the Oil Stove is Directed toward the Person Sitting near It. Spring Clamps Hold the Hood in Place, Making It Easily Removable



Two Light Metal Back Plates are Provided in This Inside-Trouser Belt, for Adjustment. Elastic Straps Also Assist in Sustaining the Garment

These Globular Tea Containers Hang from the Side of the Pot into the Boiling Water. Chain, Hook and Spoon Models are Represented

Ingeniously Arranged Springs Absorb the Road Shocks When the Baby Rides in This Motor-Car Crib. Right: Crib Folded

Perfume in the Cap Reservoir Sweetly Scents the Air When It is Radiated by the Heat of the Light Bulb

Flowers are Placed between the Copper Bristles of the Base and the Unit Placed in Water

Tongs Take the Place of the Old-Fashioned Broomstick as a Retriever of Scalding-Hot Clothes from the Boiler. A Nonheating Wooden Handle is Provided

For Beach Wear, Sandals of Light Wood Soles and Leather Retaining Straps Are Practical. They Prevent Stone Bruises and Stubbed Toes

The Leaves of the Small Table Double the Available Space When Folded Out; Handy for Tea or for Telephone

By Pulling the Handle of the Central Panel of the Cabinet, the Phonograph Comes into Operating Position. The Side Spaces Hold Records

The Extra Perambulator Seat Provides a Comfortable Riding Place for the Next Youngest and Is Also Useful as a Carrier of Bundles

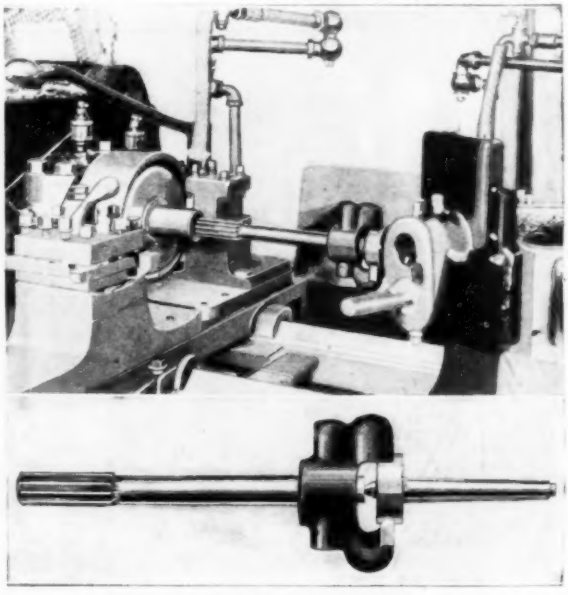
Window Display of Objects in Action: The Scenery behind the Automobile Moves Constantly So as to Give the Impression of a Traveling Car Whose Spinning Wheels Complete the Illusion. The Car is Described by Advertising Matter in Window Above

WINDOW DISPLAY PRESENTS LIFELIKE SCENES

An advertising cabinet in which miniature figures and scenery move together and show lifelike action, is built for exhibition in display windows. The cabinet is divided into an upper and lower section. In the upper section, panels bearing advertising matter relative to the scene in the lower section, drop into a window at regularly spaced intervals. In the lower section, an endless panel of scenery travels around two upright rolls, causing an illusion of forward motion of the figures before it. These figures also may be made to perform various lifelike motions. All the parts are operated by one motor, from which rods and gearing, that may be disengaged from the mechanism as desired, transmit power. In operation, the scene may be arranged to show an automobile whose wheels are spinning and behind which the roadside scenery is swiftly passing. Meanwhile, in the window frame of the upper section, descriptions of the car advertised are constantly changing.

DRILL AND REAMER HOLDER IS SELF-CENTERING

A new drill and reamer holder, for use on lathes, screw machines, and drill presses, is self-centering, saving the time of arranging a dog and tool in a toolpost, and also assuring accuracy of alinement. It consists of a sleeve with a taper-reamed hole to receive a center, that takes the place of the regular center of the machine on which the holder is used, and having a head through which a T-slot is milled at right angles to its center line. Fitted to float freely in the T-slot is a head, resembling a dog, in the form of a yoke for holding drills or reamers, and which has adjustment means for securing perfect alinement. The holder is made in two sizes, with capacities up to 1-in. shanks, and up to 2-in., respectively.



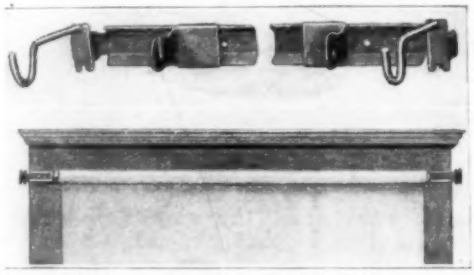
Upper View Shows the Self-Centering Holder being Used with a Reamer in a Turret Lathe. Below Is the Holder Complete, with the Reamer in Place, and Its Own Center

REUNION OF FARMERS' WIVES IS PLEASANTLY PROFITABLE

An annual reunion, during fair time, that will form a happy combination of business and pleasure, has been inaugurated in Calgary, Alberta, for the benefit of the wives of soldiers who since their return from France have become farmers. During the reunion the wives, to many of whom their present environment is completely new, will be given lessons in household and farm economics alternated with entertainments of a social nature.

NEW BRACKET ACCOMMODATES DIFFERENT SHADE LENGTHS

A new window-shade bracket has two adjustable slides which may be moved to accommodate different lengths of curtain poles. The travel of each slide is 4 in., giving a total possible adjustment of 8 in. for each shade, there being a bracket at each end for the pole. Ordinarily the bracket is made up of a base piece, which is fastened to the wall by means of screws

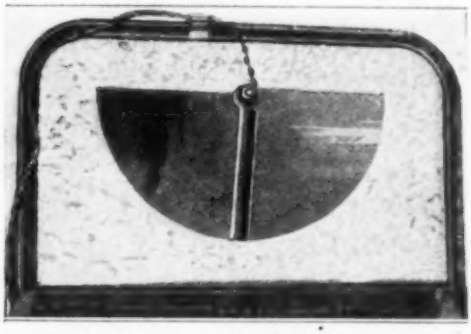


Sliding Brackets for Shades of Various Widths, Capable of an Adjustment of Eight Inches: The Hooks at the Ends Are for the Curtain Pole. Below: Shade and Bracket Mounted on Window Frame

and has at the outer end a hook from which a lace-curtain pole may be suspended, together with sliding brackets for the shade pole. But where it is desired to hang two shades with the lace curtain, a bracket with a double-notched slide is furnished.

AUTO WINDSHIELD CLEANER IS ELECTRICALLY HEATED

A cleaner for automobile windshields which melts ice and snow from the outside and also wipes the inside surface clear of mist and breath vapor, has an electrical-heating element inside one of the two arms which move over the outer surface. The temperature of this arm is raised to and held at 147° F., which is sufficient to melt ice but not great enough to damage the glass. The other outer arm, as well as the one which cleans the



The Electrically Heated Windshield Cleaner Installed: The Ice-Melting Arm is Followed by a Felt Pad Which Wipes Away the Moisture

inner surface, is fitted with felt pads which remove the moisture.

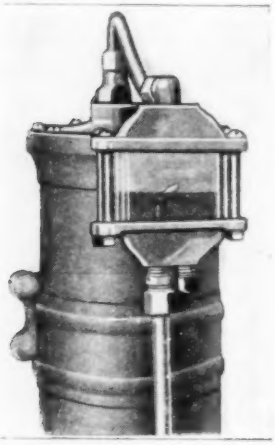
SPLIT-SECOND WATCH PERMITS TWO SEPARATE READINGS

Study and the accurate timing of the efficiency of the various motions in the doing of a piece of work in the factory, is a necessity in modern industry. A split-second watch has been developed, which will enable the efficiency man to read the time for two different operations at the same time, by means of two hands. In addition to this feature, the face of the watch carries a set of figures giving directly, without any pencil figuring, the production per hour for the operation.

¶One potent cause of eye strain in movie theaters, according to investigators in England, is peculiar to the front seats, especially popular with children, where the eyes must be uncomfortably uplifted to see the screen. It is recommended that the visual angle to the top of the screen should not be more than 35°, and the angle to the screen's sides also should be limited.

NEW AUTO GASOLINE FILTER IS VACUUM-TANK FITMENT

Cleaning gasoline before it reaches the vacuum tank by means of a compact little filter and settling chamber, which attaches directly to that device near the top, avoids many delays and annoyances, according to the claims of its manufacturer. The body of the contrivance is of clear glass, so that the gasoline flow can be observed at any time, and the filtering and sediment chambers, made of aluminum, are placed at the top and bottom respectively. Besides the vacuum-tank model, another is supplied, designed for instrument-board installation. The latter is in full view of the driver at all times.



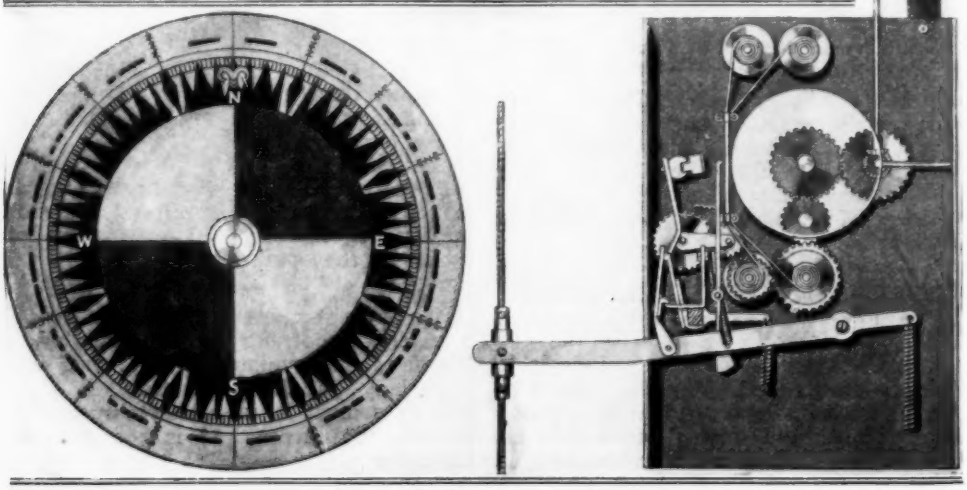
That the short ends of bars which are otherwise useless, such as reinforcing rod ends, etc., could be cheaply made useful by electrically welding them together, is the assertion of an English engineer.

LEAD-ALLOY SHEATH USED IN WATER-TIGHT WIRING

The system of obtaining water-tight fittings in electric wiring by means of screwed metal pipes is improved greatly by the use of a new, continuous water-tight lead-alloy sheath. The alloy is harder and offers more protection than pure lead, but it is sufficiently flexible to permit the bending of the cable during erection. The cable is bonded and sealed at all junctions and terminals by an internally screwed brass gland, one end of which is screwed into the cable sheath and the other into a water-tight iron box. Gasketed locknuts complete the water seal. No plumbing is required to make a water-tight job, as no flame, hot metal, or soldering is needed.

CODE-SIGNAL SYSTEM FOR FOG MAKES SHIPS SAFE AT SEA

In a heavy fog there is danger of collision between ships because the uniform signals used merely indicate their presence, and tell nothing of their course or direction. A sea captain of long experience now has devised a system in which four signal horns of different tones are used, two sirens, a shrill whistle, and a steam gong, all of which are operated by foot levers. Each of these corresponds to one quadrant of the compass, and is operated only when the ship's course lies in that general

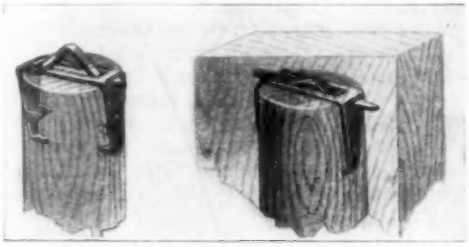


Left: The Maritime Compass Shown Divided into Four Differently Colored Quadrants for Use with the Fog-Signaling Mechanism to the Right, Which, by Means of Different Whistles and Horns, Indicates the Ship's Location

direction. The four divisions of the quadrant itself are indicated by varying the signals, as, for example, one long blast, a long and a short, a long and two short, and two long. A recording mechanism is so connected to the signal equipment that each operation prints a corresponding mark, and the time of its occurrence, on a moving tape, in ink of a color like that of the compass-card quadrant. This recorder is sealed, and serves as evidence in case of subsequent question as to the handling of the ship.

STEEL GRIP FOR WOODWORKERS MAKES JOINTS WITHOUT GLUE

A recently patented steel clamp, or grip, to take the place of glue in making joints in woodwork, is now on the market. It is particularly applicable to the rungs and posts of chairs and stools, table legs, and other parts of household furniture that so easily work loose when dependent on such a perishable thing as glue. The device is in two parts, a clamp



Steel Grip That Makes Joints in Woodwork without Glue: The Views Show the Grip on a Post, and How the Post is Locked by the Grip in a Socket

with jaws to hold it securely to the piece to be connected, and slotted into the top of this, a flat steel fastener with pointed ends. This is bent at its center in such a manner that the act of driving the part holding the clamp into the part to which it is to be connected, straightens it so that its points are driven into the latter part, and thus hold the two together.

NEW RIM ANVIL TO REPAIR TIRE WHEEL RIMS

To overcome the difficulties encountered by the garage man in repairing damaged rims, a new tire anvil has been placed on the market. It has a number of grooves and faces, flat, concave, and convex, designed to handle rims of all types in both vertical and horizontal positions. Supplied with the anvil are two hand tools of high-carbon steel, to open up grooves on lock-ring and clincher-type rims. Driving in on the rims because of blow-outs often results in the bending down of

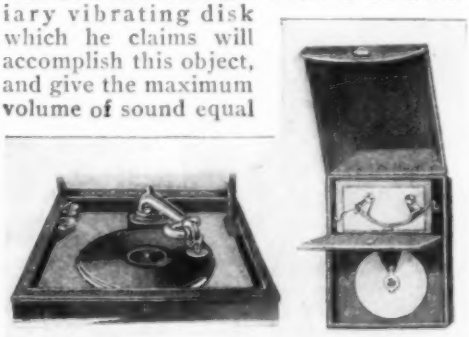
These Special Tools and Anvil, Grooved So as to Fit the Auto Wheel in Different Positions, Make Easier the Difficult Task of Straightening Out Rim Kinks

the edges to such an extent that the beads of the tire cannot be inserted.

Sprung split rims or wire wheels can also be conveniently repaired with the aid of the anvil.

VIBRATING DISK PRESERVES PHONOGRAPH TONES

The goal of effort of all phonograph manufacturers has been the reproduction of the soft shadings of the tone and expression that make music worth hearing. One manufacturer has evolved an auxiliary vibrating disk which he claims will accomplish this object, and give the maximum volume of sound equal



Left: Disk Fitted to Sound Box of a Phonograph. Right: The Disk in the Lower Part of the Case Amplifies the Tone of the Record without Destroying Its Quality

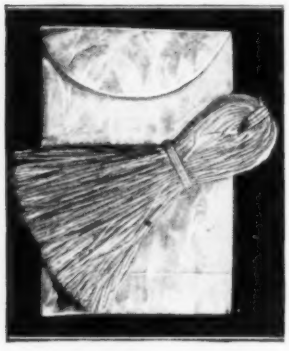
to the loudest talking-machine needle. The auxiliary disk is of a special composition and acts with a very fine-pointed and soft-toned needle. The vibrations of this needle are transmitted through the auxiliary disk to the vibrating disk of the sound box. The attachment, it is said, will also prevent injury to the record.

INTERNAL THREADS MEASURED BY MICROMETER

A micrometer that will measure internal threads, giving the operator information and opportunity for the correction of faulty conditions as to lubricants, cutting compounds, tap wear, and many other conditions contingent upon the tapping of threads, is on the market. The instrument is calibrated to .0001 in., and gives direct readings in multiples of that unit. Adjustment is provided for wear on the measuring jaws. Where holes are tapped or threaded in quantities, this instrument will be most valuable.

SANITARY SHAVING BRUSH USED ONLY ONCE

Like the paper towel that serves once and is then thrown away, is a recently invented shaving brush that is used once and then destroyed. And like the paper towel that was introduced as a novelty and came to stay for sanitary reasons, so this little brush may enjoy the same popularity. The object of this innovation is, principally, to supply barbers with a clean unused brush for each customer. It is made from a vegetable fiber and comes packed in a sanitary envelope.

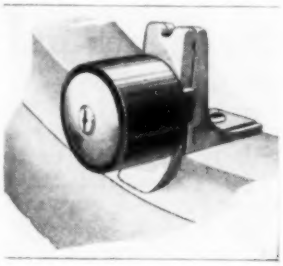


THE PORT OF GENOA, IN ITALY, TO BE IMMENSELY EXTENDED

An extension of the port of Genoa, Italy, is being carried out by the government that will increase the area of the docks and quays from 20,875,000 sq. ft. to 43,055,000 sq. ft., and the length of the railway tracks from 37 to 100 miles. The old harbor is to be improved by the addition of mechanical equipment, and by increasing its depth. When the enterprise is completed it is estimated that the port of Genoa will be capable of handling yearly 18,000,000 tons of merchandise.

SPARE-TIRE LOCK INCLOSES RIM STUD

A new tire lock designed to eliminate spare-tire thievery, consists of a malleable-iron barrel, about 2 in. in diameter, having a lug which clamps against the rim of the spare-tire holder. The bottom of the barrel is provided with a hole which slips over a standard stud, already in place, so as to hold the clamping lug in tension against the inner flange of the rim. A nut screwing down from the inside against the bottom of the barrel holds the device in place. Access is had to the nut by means of a removable cover, which forms the head of the barrel. This cover is ordinarily locked in place by means of a key, turning in a central slot and moving two lugs behind a bead in the cylindrical bore.



NEEDLE OF FINE STEEL WIRE PLAYS MANY RECORDS

Steel phonograph needles that will play from 400 to 600 records without changing are now made by a Missouri concern. The steel is in the form of a fine wire, attached to a small brass cap that fits on the end of a permanent shank. The caps are designed to nest, one over another, and by placing two or more on the shank, the tone may be softened to any desired extent. Not being tapered, the steel point retains its sharpness until it has been completely worn down to the brass cap.

¶The Shipping Board freight and passenger steamer "Golden State" recently broke the running-time record between Yokohama and Honolulu by making the trip in 8 days 9 hr. 36 minutes.

COMICAL BIRDS AND ANIMALS FORMED BY NEW JOINTED TOY

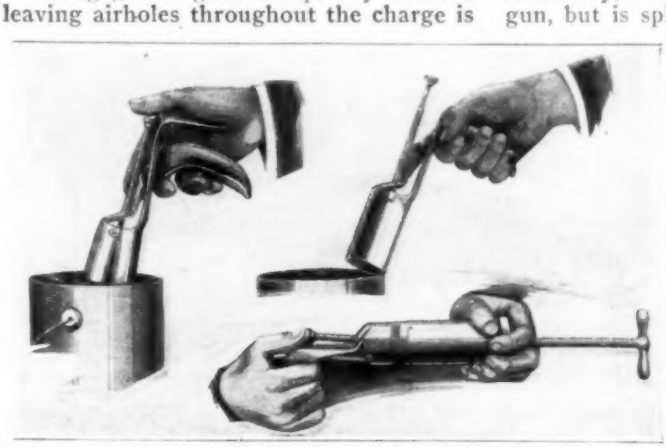
A new jointed toy, which the inventor originally intended to represent a comical cat, has exceeded his expectations many times over, as it has been found that the parts may be assembled in several combinations to form a cow, rooster, rhinoceros, hippopotamus, camel, airplane, and other animals and objects, with which children are familiar, besides quite a number that no child, or grown-up either, ever has seen or will see, except in fancy. The heads and ears of the figures can be turned and twisted at various angles, resulting in surprising and amusing effects as, with each position, some one of the hundreds of emotions from surprise and anger to hilarity and excitement is expressed. It is truly remarkable what a range of moods can be shown by the few pieces of inert wood and screws making up the novel plaything. The cat, and cart upon which it is mounted, measure 19¾ in. long by 17 in. in height and, of course, the other figures are of corresponding proportions.

Aviation has been particularly represented in the grotesque construction, as the tiny aeroplane is not only movable but carries a man in its fuselage. Wheels from the cart part which move the funny animals, also form the source of locomotion for the flier, for they serve as its landing gear. A tiny propeller is also a part of the flying equipment.

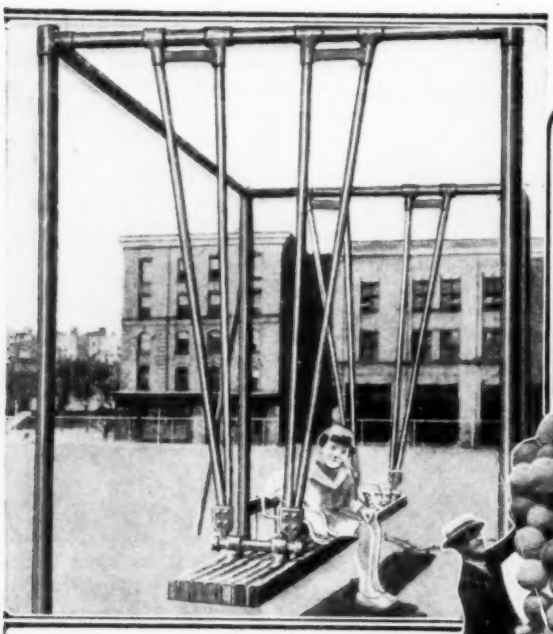
The Elephant in the Upper Left Corner, the Cat Below, and the Monkey at the Right, are Made of Interchangeable Sections. Innumerable Lifelike or Fanciful Creatures can be Built with the Set

DEVICE FILLS GREASE GUNS WITH A FULL CHARGE

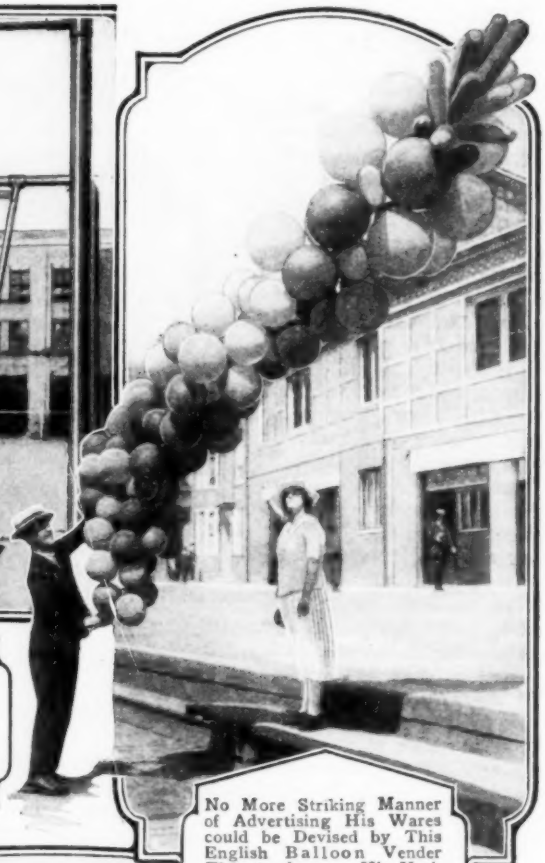
Filling grease guns completely without leaving airholes throughout the charge is quite a trick, requiring considerable skill and patience when done with a paddle. A new tool, which does the job quickly and easily, is made somewhat like a grease gun, but is split lengthwise, forming two half cylinders hinged together at their tops and inclosing a piston. To use, the halves are opened by hand pressure on a two-part handle, and the whole is pushed endwise into the grease for its full length. The handle is then released, allowing the halves to come together and trap the grease between them. The now filled tool is inserted into the end of the grease gun and its contents transferred by means of the piston, which is actuated by a simple thumb-operated plunger rod.



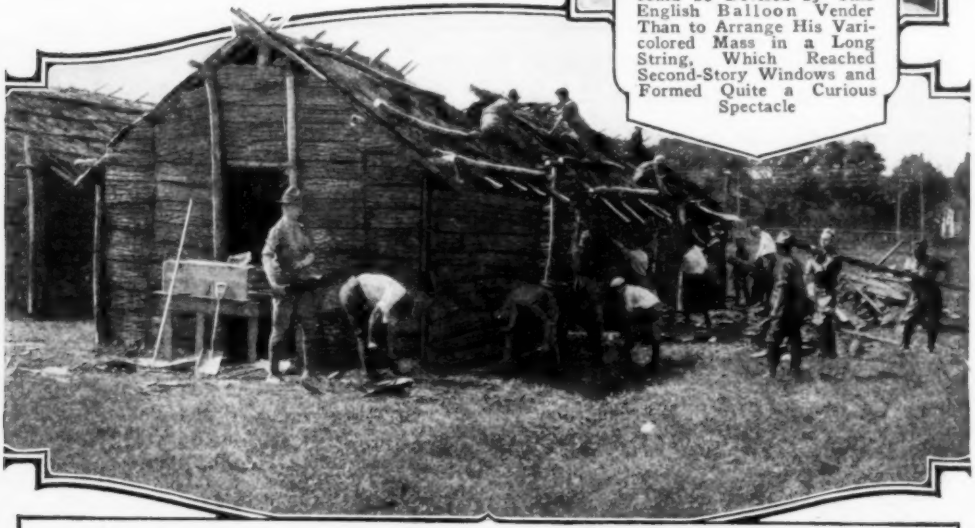
Difficulty is Encountered in the Old Method of Filling the Grease Gun by Means of a Paddle. This Filler Mechanically Insures a Full Charge of Grease without Air Pockets



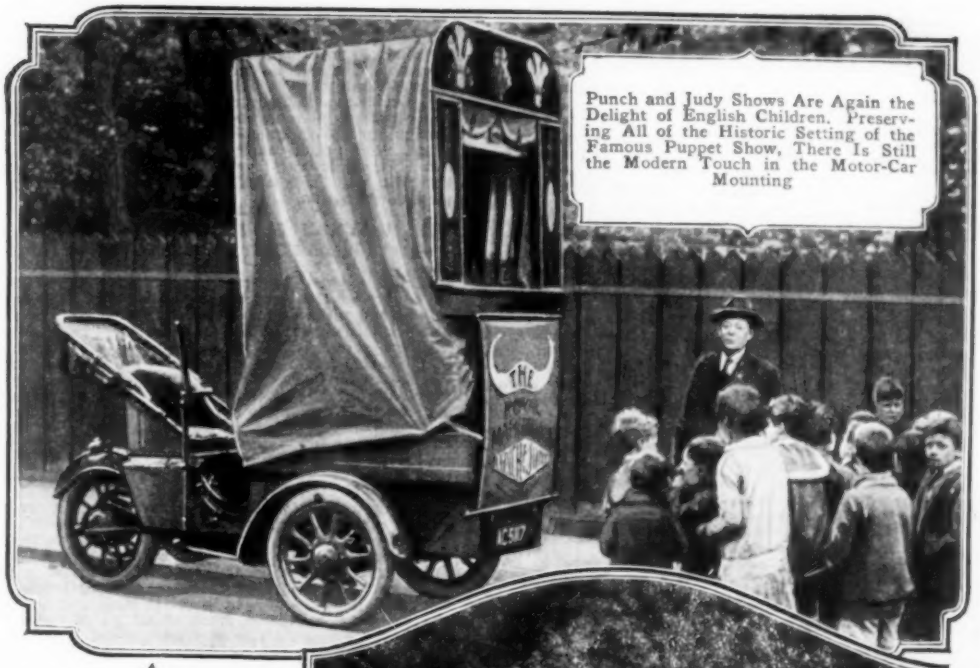
Five Kiddies can Enjoy the Comforts of This Swing, Which Is Part of the Equipment of a New York City Playground. Individual Seats are Provided for the Children, and the Swiveled Stays Produce an Even Swaying Motion from Side to Side Instead of the Usual Backward Movement



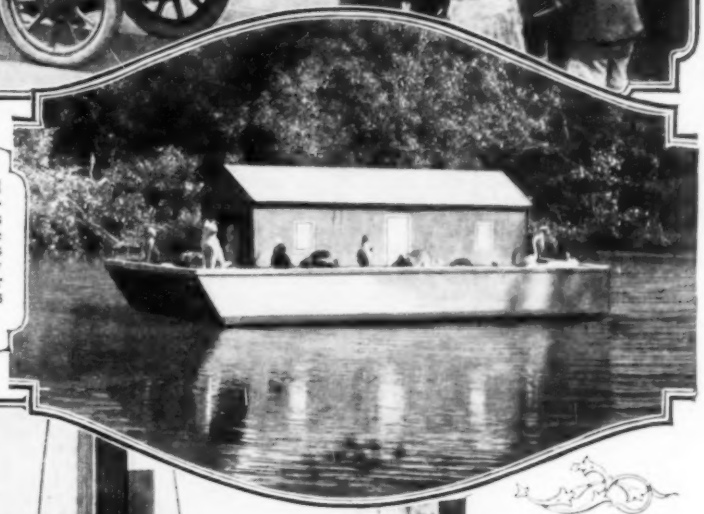
No More Striking Manner of Advertising His Wares could be Devised by This English Balloon Vender Than to Arrange His Varicolored Mass in a Long String, Which Reached Second-Story Windows and Formed Quite a Curious Spectacle



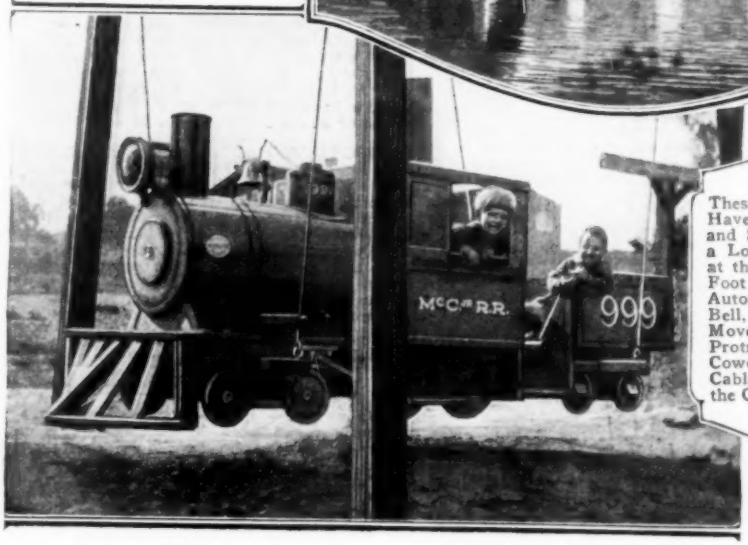
Forty Boy Scouts Built a Mohawk Village Consisting of a "Long House" and Six Smaller Huts, at Springfield, Massachusetts, without the Use of Tools or Nails. The Frame, Constructed from Trees, Felled by Burning at the Base, as the Indians Did, is Lashed Together with Strips of Tough Bark. The Bark Forming the Sides and Roof is Held in Place by Poles Lashed to the Frame



Punch and Judy Shows Are Again the Delight of English Children. Preserving All of the Historic Setting of the Famous Puppet Show, There Is Still the Modern Touch in the Motor-Car Mounting



Noah's Ark Hardly Carried a More Varied or Interesting Assortment of Animals—from Foxes to Chinese Pheasants—Than Did This Modern Version, an Entry in a Western College Water Carnival. Only Vicious Animals were Excluded



These California Youngsters Have the Double Pleasure and Sensation of Riding in a Locomotive and a Swing at the Same Time. The 12-Foot Replica Includes an Automobile Headlight, a Bell, and a Whistle. The Movement of the Sticks, Protruding Just behind the Cowcatcher, against the Cables Produces the Air for the Operation of the Whistle

LATEST DEVELOPMENTS IN SCIENTIFIC RESEARCH

By C. A. BRIGGS

EFFICIENCY OF FOG HORNS DETERMINED FROM TEMPERATURE MEASUREMENTS

Fog horns have recently received scientific study in an effort to increase their power and effectiveness. From experiments on "diaphones," a type of fog alarm used in Canada, it appears that the smaller sizes are much more efficient than the larger ones. With the largest units the efficiency is about 8 per cent while in the smaller forms it may reach 20 per cent. The indications are that the best results would be secured for producing powerful signals with a device composed of a number of small units. In such an arrangement, it will be necessary for the vibrations from each unit to be exactly controlled, so that they will be of precisely the same frequency as all the others, and each arranged to be in proper step with its neighbor. Otherwise, the strength of the sound will be very much diminished, and the advantage of this form of construction will be lost. One proposal, due to the late Lord Rayleigh, is to locate the individual sounding elements in a vertical row with a certain spacing, devised to concentrate the sound in a horizontal direction.

It is of interest to learn that the efficiency of fog horns is determined by means of temperature measurements. A resistance thermometer, or thermocouple, is placed so as to measure the temperature of the air under pressure before it enters the horn; and another is arranged to measure the temperature in the throat after the air has been released and has practically reached atmospheric pressure. The greater the efficiency the greater will be the drop in temperature. When the temperature of the atmosphere is a few degrees above freezing, the drop in temperature is sometimes sufficient to cause water to condense and ice to form.

GERMAN SCHEMES FOR SECRET SIGNALS

German war secrets are now being disclosed in scientific literature. At the close of the conflict the Germans in their laboratories were working on secret-signal lights of special character. To the ordinary observer nothing would be present to indicate that the light was sending out signals, but changes would be going on which would be apparent to a person equipped to view it with a suitable optical device.

Different principles were employed for accomplishing this. In one of them polarized light was to be sent out by the signal, the character of which would change in accordance with the dots and dashes of the code. When viewed through properly equipped binoculars, the color would no longer be white but would alternate between red and green. In another method, a glass screen containing compounds of the rare element didymium was arranged to alternate in the beam of light with another screen of suitable shade. When the resulting light was viewed with binoculars equipped with prisms, a black line would appear in the yellow region of the spectrum formed whenever the didymium glass was interposed, permitting the signals to be read. Another method consisted in first breaking up the light at the source into a spectrum across which was placed one or more wires cutting out narrow regions of color, and these were arranged to be moved back and forth a short distance along the spectrum in signaling. The colors were then recombined into white light and transmitted. With binoculars provided with suitable prisms to re-form the spectrum, the signal was perceived in the motion of dark bands back and forth along the spectrum, corresponding to the movement of the wires at the transmitting station. One important application of this method of signaling would be at sea.

CENTER OF VISION IS NOT ALWAYS MOST SENSITIVE TO LIGHT

All portions of the retina of the eye are not equally sensitive to light. For instance, in winter the glare of the snow striking the upper portions of the retina is usually uncomfortable, and often it is a serious matter. The equally bright light of the sky falling upon the lower portions causes no similar difficulty. It has been known for a long time that faint stars are often picked up best by looking at them indirectly. Recently, an astronomer has contributed additional information of interest. From his experiments he concludes that the outer side of the retina is more sensitive to either red or green light than the inner side, and that this is true for the average star. The lower portion is more sensitive to green than the upper, but with red light and for the average star the upper portion is more sensitive. The most sensitive portion for red light is in the upper and outer quadrant of the retina between 1° and 3° from the center. For white stars averted vision is the most sensitive but with red stars the advantage tends to be with direct vision.

OXYGEN SUPPLY CONTROLLED BY HEAT LEAKING IN

Liquid oxygen has many advantages as a source of supply of the gas; for instance when the weight of the apparatus is important, as for a breathing apparatus. Recently a simple and effective method of regulating the supply of oxygen obtained from the liquid state, has been devised. The temperature of liquid oxygen is low so that it is generally stored in vacuum bottles, and the quantity which vaporizes in a given time depends upon the heat received. In the particular device referred to, the bottle is made of copper except for a certain portion of the outer wall in the bottom, which is composed of a flexible diaphragm of silver, at the center of which is soldered a copper block, shaped to fit the inner wall. By means of a screw the block can be brought from a completely separated position to close contact with the inner wall. For each position of block there is a certain rate at which the heat is conveyed to the liquefied oxygen to vaporize it. In this manner it is possible to control, by means of the simple screw, the rate at which the oxygen itself is delivered for use, and this can be varied from about ½ qt. to about 12 qt. per minute. The average amount required for an ordinary safety breathing device is about three quarts.

MUCH ENERGY WOULD YIELD BUT LITTLE MATTER

The foundation on which much of the progress of chemistry has been built was the proposition that matter is indestructible; and likewise the notion that energy was indestructible, or the theory of the conservation of energy, was responsible for reconciling the laws and ideas of physics, and pointed out the way for tremendous progress. More recent investigation has shown an interrelation between these two things—matter and energy—and that, as in radioactive substances, energy may appear at the expense of matter, so that according to more recent ideas the sum total of matter and energy is constant, but each one of them separately is not necessarily so. However, a small quantity of matter corresponds to a prodigious amount of energy, and reversely a very large amount of energy corresponds to a very small portion of matter. For instance, Lord Rayleigh recently stated that the energy of a beam of sunlight, 4 in. square, if it could all be converted into matter, would have to shine 17 years to produce one-tenth milligrams or about .000,000,2 lb. of substance.

SUN SPOTS AFFECTED BY THE EARTH

The position of the earth appears to have a slight, but definite influence on the spots formed on the sun. At a recent meeting of scientific men in Washington, a curve was shown derived from observations of the "sun-spottedness" extending over a period of 44 years, from 1876 to 1920. This seems to indicate that on the average, about the time the earth is nearest the sun, that is, in January, sun-spottedness is at a minimum, and the maximum occurs in July when the earth is farthest from the sun.

BACTERIA PRESERVED BY FREEZING AND DRYING

In some instances it is of great importance for medical purposes to preserve bacteria. It is found that many kinds can be kept for relatively long periods of time with their original vitality, if they are first frozen and then dried in that state. This method is successful, while if the drying were carried out without first freezing, it would result in the immediate death of the organism.

Shop Notes

Information as to where to obtain any specified materials or parts for making objects described in the following pages may be had, on request, from our Bureau of Information.—Editor.

Rolling Logs with Tractor

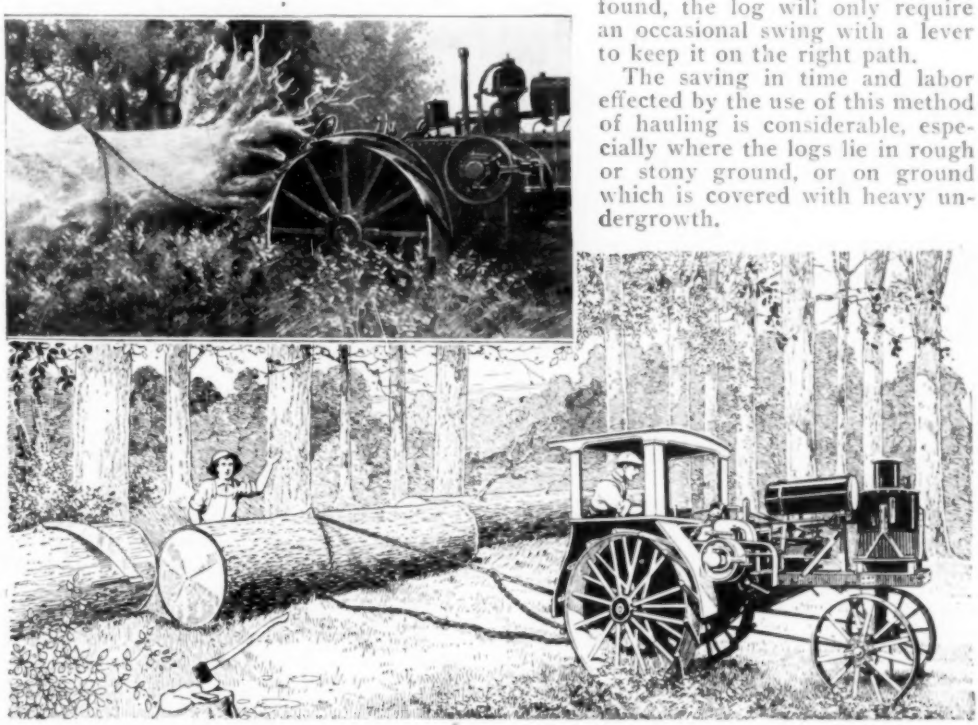
BY GEO. G. McVICKER

IT often happens, when clearing land, or when cutting timber for other purposes, that some of the logs, even when cut into fairly short lengths, are too heavy either to load on a sled or to drag away, without spending an abnormal amount of time and labor in cutting brush, rigging tackles, and laying skids or rollers for the logs. In such cases, the tractor may be pressed ito service with good results.

The method of doing this is clearly shown in the illustration. A chain, about 100 ft. long, is wrapped once around the trunk, then the ends are fastened by some form of easily detached hook. A short chain, with a hook on its end, fitting into the links of the long chain, is fastened to the drag link of the tractor. When the long chain is in position, the tractor is backed up to the log and the hook placed in one of the links on the top portion of the chain, then the tractor moves forward, rolling the log easily behind it over the ground. When the end of the chain loop is reached, the hook is detached, the tractor backed again, and the process repeated.

It may be necessary, with logs having portions of the roots attached, or where the diameters of the logs are different at each end, to place the chain nearer one end of the log, in order to counteract the tendency of the log to roll in a circle, but once the proper position of the chain is found, the log will only require an occasional swing with a lever to keep it on the right path.

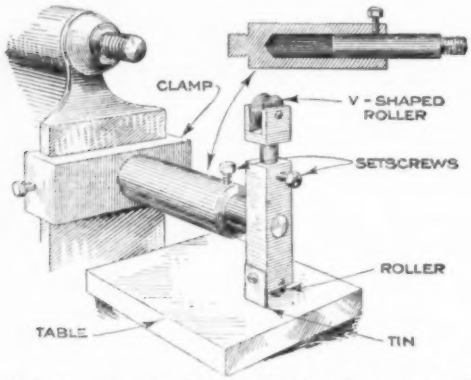
The saving in time and labor effected by the use of this method of hauling is considerable, especially where the logs lie in rough or stony ground, or on ground which is covered with heavy undergrowth.



Utilizing the Tractor for Hauling Logs That Are Too Big to be Lifted or Dragged Easily: The Only Equipment Necessary, besides the Tractor, Is Two Lengths of Chain and a Couple of Hooks

Roller Steady Rest for Milling Machine

When milling long pieces of stock of small diameter between centers, the steady



A Steady Rest for Milling Machines That Makes It Possible to Machine Long Pieces of Small-Diameter Stock between Centers

rest shown in the drawing will be found an accurate means of keeping the work to size throughout, as the rest is always in its proper position—underneath the cutter.

A flat piece of stock is bent to form a clamp that will fit the ways on the column, to which it is secured with a single setscrew. Next, a piece of mild steel is threaded at one end to fit a tapped hole in the clamp, and the inside is bored out or drilled to take the piece to which the vertical rest is secured, so that the whole device can be adjusted horizontally. The V-shaped roller that supports the work is adjustable vertically. At the bottom of the rest, and protecting the roller that bears upon the table of the machine, is a strip of tin that serves to push the chips out of the way of the roller.

The work is first of all set up between the centers in the usual way, and the cutter set to the proper depth of cut. The roller rest is then fixed in its proper position and adjusted until the grooved roller makes a snug fit underneath the work, when the setscrew holding the adjustment is tightened. It will be seen that as the table moves along, the rest will remain at all times in the same position underneath the cutter.

Using Stainless Steel

Stainless steel, which was developed several years before the war by an English steel company, is rapidly coming into more extensive use in that country.

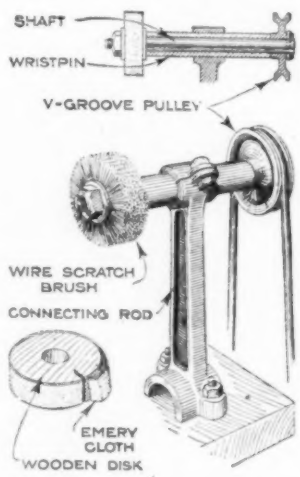
The steel, which is composed of carbon, chromium, silicon, and manganese, has a great resistance to rust and staining, and was for this reason, first used extensively in the manufacture of cutlery.

Some of the other uses for stainless steel are: mirrors for optical work, and pivots for optical instruments exposed to the action of sea water; pen points and springs for drawing instruments; vernier calipers, squares, and scales; shafts and plungers for water pumps, in which service it has been found at least as good as bronze, and is stronger and wears better; valves and wristpins for internal-combustion engines; wire for fencing and cables, and for various other purposes.

The best results are always obtained by polishing the steel to the highest possible degree, and it should be borne in mind that the metal must be hardened at a temperature of about 150° C. (302° F.) higher than the hardening temperature of ordinary carbon steel.

Buffing Wheel for Tire Shop

Using an automobile connecting rod as a base and a wristpin for the main bearing, the inexpensive and easily made buffing head shown in the drawing makes a valuable adjunct to the equipment of the tire repairman for cleaning out cuts and finishing work rapidly. The big end of the connecting rod is bolted to the end of the bench so that tires can be handled in any position on the wheel, mounting the wristpin in the upper end and tightening it with the clamp. Any rod, a running fit in the wristpin, will serve for the shaft, to one end of which a grooved pulley, which may be an old fan pulley, is attached, while the opposite end takes the buffer or scratch brush. In case a wire scratch brush is not available, a wooden disk may be used, faced with the coarsest emery cloth, which is renewed as the abrasive wears away. The fixture can be driven from an overhead shaft or from an old starting motor located underneath the bench.



Reproducing Drawings Economically

The ordinary duplicating machine can be used to advantage for reproducing maps, plats, and other drawings at a considerable saving over the cost of etchings or halftones. The drawing is first made on a piece of paper to the proper scale, then placed on the stencil, and the drawing gone over with a stylus. After the original drawing has been removed, the stencil can be placed in the typewriter and suitable titles and explanatory matter written in. The completed stencil is used in the duplicating machine in the same manner as one containing nothing but straight typewritten matter.—Herbert C. Crocker, Edwardsville, Ill.

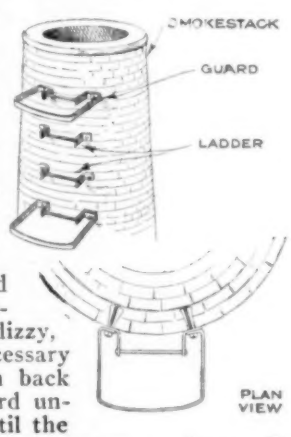
An Emergency Pinion

A rawhide pinion, driving a heavy-duty planer, became stripped, and as it would take a week or more to replace it, it was deemed necessary to make some sort of substitute for it.

Pieces of an old leather belt were placed between two ⅜-in. steel plates, the whole being securely drawn up with rivets. The blank thus formed was bored and cut in the usual way. The new gear arrived in about 10 days, and was placed in reserve rather than tie up the machine to remove the emergency pinion, which was still giving good service.—A. A. Stafford, Reno, Nev.

Guard for Smokestack Ladders

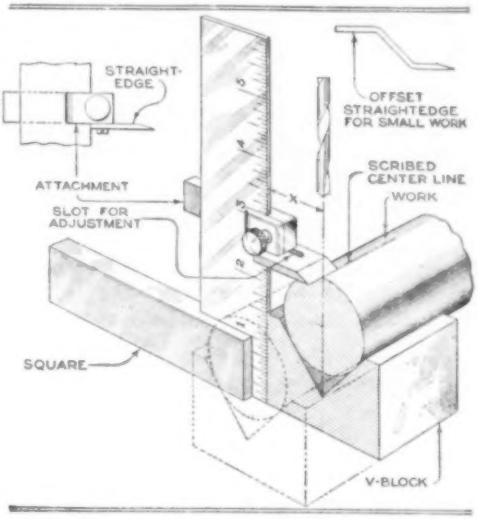
As considerable "nerve" and strength are required to climb to the top of the ladder usually built on the outside of tall smokestacks, guards should be provided at intervals for the safety of the workman.



Such guards are easily made and attached to the rungs of the ladder and form a body support so that, should the climber become tired or dizzy, it is only necessary for him to lean back against the guard until rested, or until the attack of dizziness passes. — James E. Noble, Portsmouth, Ont.

Try-Square Centering Attachment

An easily made device to clamp on the blade of a steel try-square, for laying out



An Attachment for the Try-Square That Facilitates the Layout of Cylindrical Work to be Drilled or in Which Keyways are to be Cut

center lines on cylindrical work, is shown in the illustration. As the attachment slides up and down on the blade and can be clamped in any position, work of any size that the V-block will accommodate can be center-scribed. The attachment will be found especially convenient in laying out work for drilling, marking keyways, etc. A piece of steel plate is grooved to make a sliding fit over the try-square blade, to which it is clamped by means of a small plate and knurled thumbscrew. To the bottom is screwed a straightedge blade made of tempered tool steel; this may be provided with a slot, if desired, for adjusting to different-sized V-blocks. The final adjustment of the straightedge blade should be such that the distance X, from the edge of the try-square blade to the beveled edge of the straightedge blade, equals the exact distance from the side of the V-block to the center of the "V."

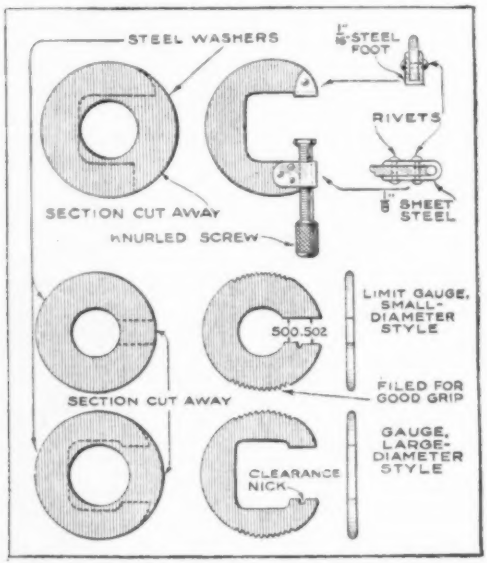
When laying out for drilling, the work is clamped in the V-block, or blocks, and the distance from the end to the center of the required hole scribed on it, at right angles to the axis. The try-square is set vertically on the drill-press table, the attachment slipped over and moved down until the straightedge touches the work, the front edge of the blade being held against the side of the V-block. Then the clamp screw is tightened, and taking

care to see that the try-square stock rests squarely against the table, and the blade against the V-block with stock at right angles, the center line is scribed intersecting the previously marked transverse line.

If the V-block is of the precision type, the mark may be checked by bringing the square up against the other side; otherwise, the same side of the block must always be used. In case the work is so small that it lies below the edges of the "V," an offset straightedge, extending down into the "V," may be used.—H. H. Parker, Oakland, Calif.

Tools Made from Steel Washers

The common C-clamps that one usually buys are easily broken, due to the use of malleable iron for the frame. Ordinary steel washers of suitable size, ground and polished, can be utilized to make a substantial set of clamps, as well as small-diameter snap gauges.



Snap Gauges and C-Clamp for Work of Small Diameter That can be Made in the Small Shop from Ordinary Steel Washers of Different Sizes

In making the clamps, a section of the washer is cut away, as shown in the drawing, and to the remaining part a U-shaped steel foot is riveted, to form the clamp face. Another U-shaped piece is riveted to the opposite side and tapped to take an adjusting screw of suitable type and size. If additional strength and finish are desired, the product may be casehardened.

The manufacture of the snap gauges is carried out by cutting a section out of the washer, the width of the opening being brought to the minimum size by filing or grinding. Then, with a three-cornered file cut the notch in the center of one of the faces and enlarge the half face in the front to the maximum size. Rounding off the edges completes the work and leaves it ready to be hardened; this is done by dipping the gauges into melted potassium cyanide (poison) until they attain a good red heat, then quenching in cold water.

After hardening, the gauges should be checked for size and the faces lightly lapped bright with a fine-grained oilstone.

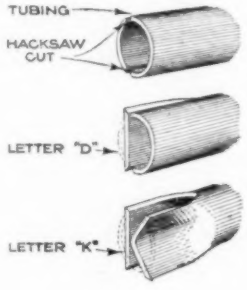
Antique-Green Finish for Brass

An antique-looking green-bronze color, or finish, can be given to brass articles by repeated applications of a solution of dilute acetic acid and exposure to the fumes of ammonia. A somewhat quicker method of obtaining similar results consists in immersing the article in a solution made in the proportion of 1 part perchloride of iron to 2 parts of water. The depth of color depends upon the time the work remains in the iron solution.

A similar color can be obtained on copper by applying vinegar in which some blue vitriol and common salt have been dissolved. This mixture is applied to the surface with a brush. After the desired finish has been obtained, the work is washed, allowed to dry slowly, and finally lacquered.

Wood or Leather-Branding Dies

A set of serviceable wood or leather-branding dies that may be used either with a hammer or heated, can be made cheaply, with a little patience, from metal tubing of the proper size by splitting the tubing for a short distance at the end. After the proper number of cuts have been made, the semicircular sections and segments of tubing are pressed or pounded into the proper shape and afterward dressed off with a file to sharpen the letters and even up the faces.—Serg. Kellum, Annapolis, Md.



MAKING A SIX-INCH BENCH LATHE

By J. V. ROMIG

A LATHE is the most universally useful machine in the small shop, and the first machine thought of when equipping either a small experimental shop or a more ambitious one.

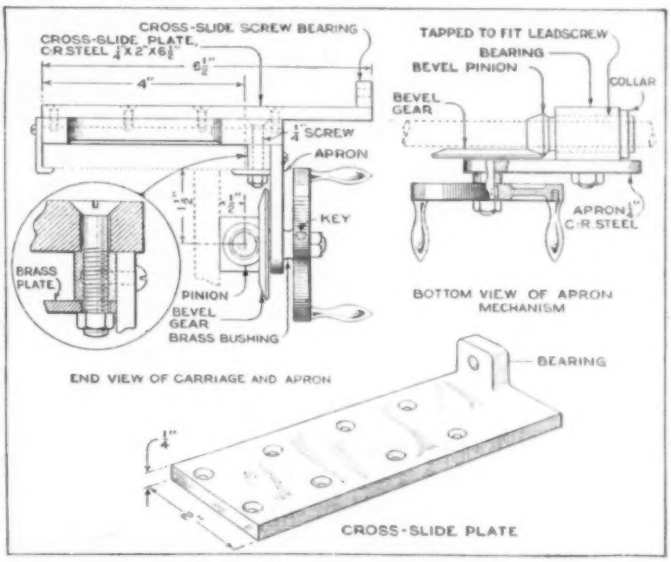
To the man with only a limited amount of money to spend for equipment, the price of a good bench lathe is almost prohibitive, but there is no reason why any mechanic could not build a substantial lathe, of the design herein described, at a relatively small cost.

The design of this lathe makes for a minimum amount of machine work, as cold-rolled steel flats are used wherever possible, while accuracy and strength are not neglected, the cone pulley being placed at the end of the headstock spindle, thus permitting this pulley to be large, to secure greater driving power, and at the same time providing for a headstock that is easily made and machined.

The flat cold-rolled steel construction, with the parts rigidly screwed together and sweated at the corners, makes a bed that is accurate and stiff, and one not subject to excessive vibration. The steel stock may be obtained through any steel-sales company, and the various pieces should be checked for even thickness and flatness before assembling, any thick spots being carefully scraped, and the pieces trued to an accurate straightedge or surface plate.

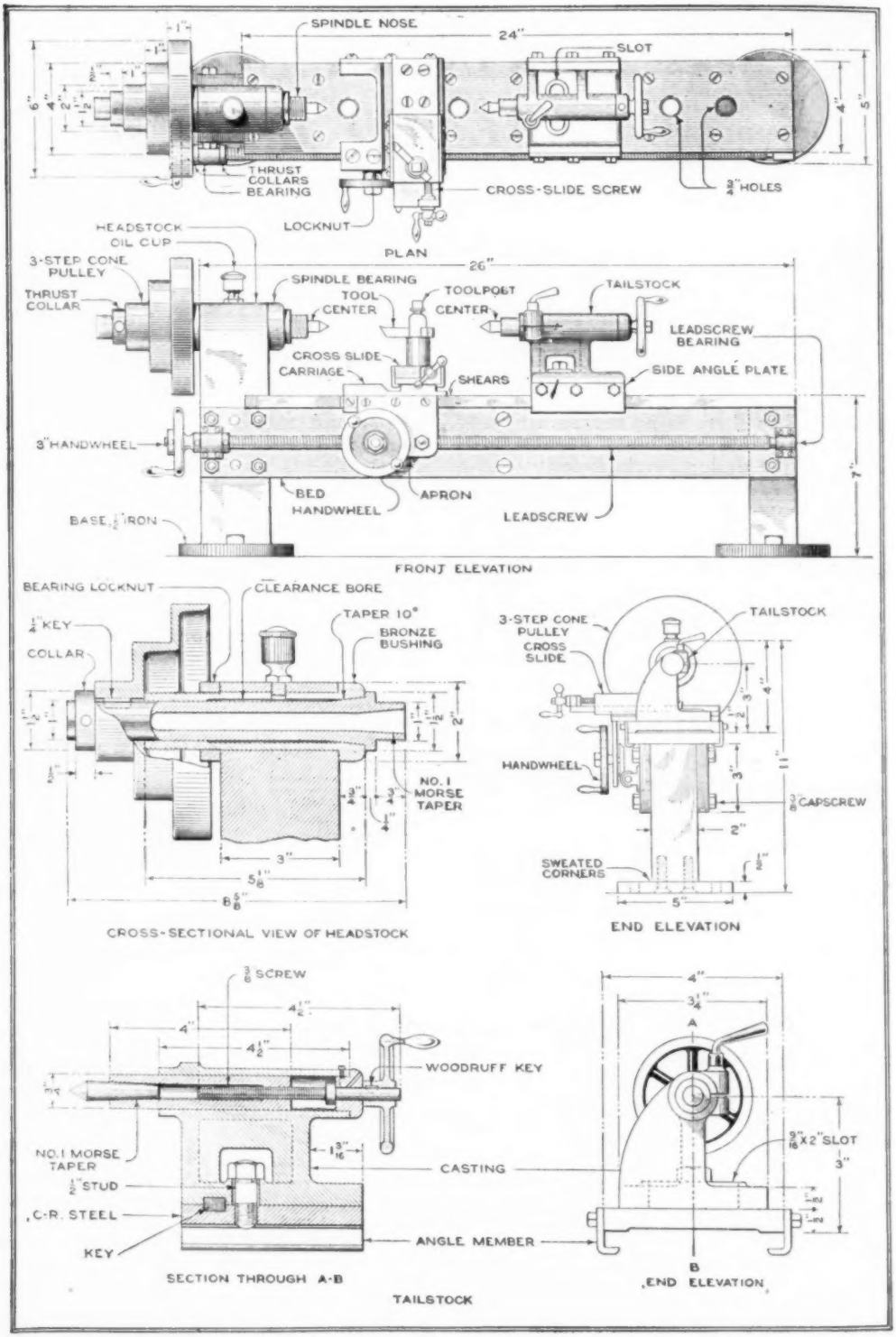
The bed, or shears, is built up of three pieces; one piece, ½ by 4 by 24 in., for the top, and two pieces, ½ by 3 by 26 in., for the sides. The headstock and leg are cut from one piece of steel, 2 by 3 by 10½ in., and the rear leg from a 2-in. square piece, 6 in. long.

Beginning with the top part of the shears, lay out all the necessary screw holes, and mark the section to be cut out to fit around the headstock; mark also the holes along the center of the top plate of the shears. These are chip holes and should be ¾ in. in diameter. Next, lay out the holes in the sidepieces to take the capscrews that hold these members to the legs, then drill all marked holes in top and sides. Clamp the legs and sidepieces together in the proper position, lay on the top piece, squaring everything accurately, then scribe through the holes to mark the location of the screw holes in the edges of the sidepieces and the capscrew holes in the legs. While in this clamped position, scribe a line across the face of the headstock, 3 in. above the top of the shears, this being the height of the center of the spindle. After drilling and tapping all small holes, machine



Details of Carriage Assembly, Arrangement of Apron Feed Mechanism and Cross-Slide Plate, and Method of Constructing Front Carriage Shoe, or Angle Member

the headstock as shown in the sectional view, boring and reaming a ½-in. hole in the center of the scribed line. This finished, make the bronze shouldered and threaded bushing. This bushing is taper-bored at the front end, the spindle also

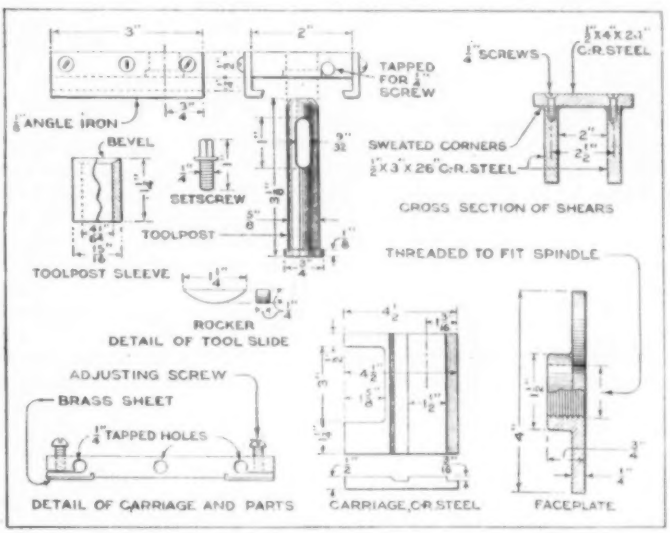


A Six-Inch Lathe That Possesses Features Not Found in the Usual Homemade Tool: With the Exception of the Tailstock Casting and Cone Pulleys, All Details are Made of Cold-Rolled Steel, Flat and Bar Stock, and Bronze Bar. This Makes a Very Rigid and Accurate Machine, and One That will Repay Fully the Time Spent in Its Construction

being tapered to suit. This makes an adjustable bearing that can be taken up for wear, and is the most desirable bearing for lathes of this type. The bore is recessed slightly between the front and rear bearings, thus producing both the necessary clearance and an oil well at the same time.

The spindle must be a nice running fit in both bearings, and, if possible, should be casehardened and ground, although this is not absolutely necessary; if it is properly fitted, and kept well lubricated, it will last a lifetime. It is drilled ⅜ in. all the way through, the nose being bored No. 1 Morse taper, this size allowing broken-off drill shanks of that taper to be utilized as centers, etc. The cone pulleys may be obtained from a machinery-supply house, but if this is not convenient, a simple pattern may be made and the pulleys cast in soft gray iron, then machined, both inside and out, to obtain good balance. If cast pulleys are not desirable for any reason, they may even be made from a solid 6-in. bar, although this means quite a big job. The pulley for the headstock should be bored and fitted with a key, while the one for the countershaft needs only a ⅝-in. hole and setscrew.

Drill and tap the hole for the oil cup, allowing the shank of the cup to enter the hole in the bronze bushing, to keep the latter from turning.



Details of Shears, Front Carriage Shoe, Carriage, Cross Slide, and Toolpost Parts, with Part Sectional View of Faceplate: Note the Method of Adjusting the Front Shoe of the Carriage

The tailstock is the most elaborate part of the whole lathe to build. It is a casting, which, of course, necessitates a pattern, and is made of soft gray iron. It is machined to the dimensions in the drawings, and is fitted with a steel sleeve, ¾ in. in diameter, the nose being bored to No. 1 Morse taper. The casting is fastened, by means of a stud, to a base of ½ by 4 by 4-in. plate, which is fitted with ⅜-in. angle members. These angle members are clamped to the base by ⅜-in. capscrews, and hold the tailstock rigidly to the shears. A square-bottomed groove is shaped across the top of the base, lining up with a similar groove in the bottom of the tailstock casting; in this groove fits a key that holds the casting square and in line; the base is also drilled and tapped for the ½-in. clamp stud. After machining the bottom of the casting flat and even, place the assembly on the shears and lay out the center of the spindle hole, 3 in. from the shears; when the spindle hole is bored and reamed, slit the casting and fit the clamping screw. An end bearing and spindle screw, together with a handwheel, are then made and fitted. By making the tailstock of this design, it can be thrown off center for taper work, and by removing the casting and bolting an angle plate to the base, the lathe can be used for other work, such as boring and milling on model work, setting the base ahead of the carriage, if necessary, and utilizing the carriage feed for the forward movement. After the headstock has been reamed for the bushing, assemble the shears, headstock, and rear leg, tapping the screws lightly with a small hammer on the end of the screwdriver and setting the screws up firmly by means of a wrench applied to the screwdriver; before tightening, line up the headstock with the shears by means of an accurate square. When it is perfectly square, and the capscrews tight, drill and ream the taper-pin holes and drive in the pins; this will hold the headstock true.

The rigidity and general stiffness of the lathe bed may be increased by sweating the parts together and then soldering fillets in all corners.

To do this, copperize the steel with copper-sulphate solution, before assembly; then, after assembling, use a heavy soldering copper, with borax as a flux, and run the solder in well around all edges, building up good fillets.

After assembling shears, headstock, and legs, go over the whole bed with scraper and straightedge, touching up the high spots, and getting as accurate a surface as possible; the more accurate the surfaces, the more accurate will be the work.

The lathe carriage is of simple, rigid construction, and will stand the work of taking heavy cuts, as well as the accurate finishing of fine work. The main member is the top plate of cold-rolled steel, shaped as shown, and machined on top to clear the angle members on the cross slide. On the 1½-in. flat on this plate is screwed the cross-slide plate, of ¼ by 2-in. bar, 6½ in. long; this is fitted with a bearing for the cross-slide screw. This plate must be absolutely square with the shears.

The rear edge of the carriage plate is fitted with a 3/16-in. angle member, held by ¼-in. round-head screws, while the front-edge angle member or shoe, is built up as shown in the enlarged detail, using a piece of ½-in. square steel, with a brass plate under the shears, fastening with countersunk screws and nuts. The ½-in. bar is slit at the ends, fitted with thin brass liners, and tapped for adjusting screws, which enable the carriage to be adjusted to the right degree of tightness.

The apron is fastened to the front of the carriage plate by round-head screws, and may be fitted with the feed shown if desired. As may be seen, this consists of a handwheel, keyed to a spindle carrying a bevel gear back of the apron; this gear engages with a bevel pinion, tapped for the leadscrew and running freely in a bearing on the back of the apron. This feed may be omitted if desired and a solid nut, screwed to the apron, used instead.

The main feed is through the handwheel on the end of the leadscrew, which allows of a very fine, steady feed.

The leadscrew is ½-in., 20 pitch, and runs in small brass or bronze bearings at each end of the bed.

The cross slide is made of ½ by 2 by 3-in. cold-rolled steel, fitted with angle members; it is drilled and counterbored for the toolpost, and drilled and tapped for the ¼-in. cross-slide screw.

The shoulder on the toolpost fits the counterbore in the slide, thus holding the post in place; a sleeve is made, as shown, to fit over the toolpost, and is beveled at its upper end for the rocker. The toolpost is slotted for ¼-in. tools, and is fitted with a ¼-in. shouldered screw.

By removing the toolpost and substituting a shouldered ½-in. screw, parts for machining may be bolted directly to the carriage.

When the lathe is finished, place a bar between centers, and turn it, checking carefully at both ends of the bar with a micrometer caliper, to see that they are of equal diameter.

It may be necessary to set over the tailstock casting slightly, until a perfectly true piece of work has been turned; when this is done, scribe a vertical line across the ends of the tailstock casting and base, and sink the line in deeply; the casting and base should always be lined up by means of this mark whenever the tailstock has been set over for taper turning, or removed from the base when using an angle plate.

Faceplates may be made, of several diameters, to suit the spindle nose, and a three-jaw universal chuck, together with a No. 1 drill chuck, should be part of the equipment. Other attachments will suggest themselves to the builder from time to time, as the necessity arises for their use.

While this lathe is simple in design, and easy to build, it is capable of a wide range of accurate work, and due to the large size of the cone pulley made possible by the design of the headstock, it is much more powerful than most lathes of its size.

Killing Molds on Lumber

Molds thrive on the surface of wood when it is moist and warm. In a dry kiln, molds often develop on the surface of lumber to such an extent that they seriously obstruct the circulation of air through the pile. This is such a decided hindrance to successful kiln drying that steps must be taken to prevent the mold growth. Various experiments have been made by the U. S. Forest Products Laboratory to find a means of accomplishing this result, without injury to the lumber.

The safest method found of stopping the growth of mold on lumber is to steam the stock at 170 or 180° F. for a period not exceeding one hour. This treatment heats the surface of the stock sufficiently to kill the mold, and at the same time the saturated air prevents too rapid surface drying, so that the injurious effects which

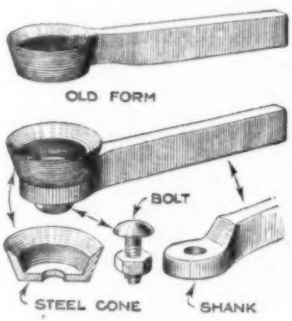
otherwise would be produced on the wood by such high temperatures are avoided.

Unless it is desired to relieve drying stresses at the same time, the interior of the stock should be heated as little as possible. Therefore, the steam supply should be sufficient to reach the desired temperature in 25 or 30 minutes. To accomplish this result, plenty of live steam at a pressure of at least 70 lb. gauge must be available. The size of supply line and the number and size of perforations that may be required in the steam-jet line will vary with local conditions, as the quicker the steam is supplied the better the effect.

Care should be taken to see that the stock cools in nearly saturated air. Otherwise the surface will dry too rapidly, and casehardening will set in.

Improved Wood-Turning Tool

An old but useful form of wood-turning tool for heavy work is shown in the upper drawing. A better form of this tool is made by turning a hollow, truncated cone out of tool steel, beveling the edge and mounting in a toolholder, in the manner shown, with a bolt. When one part of the edge is dull it is a simple matter to loosen the nut, move the cone through part of a turn and tighten, thus exposing a fresh cutting edge to the work.



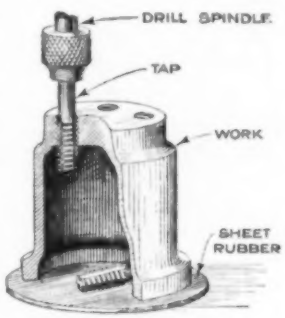
Size of Aggregates in Concrete

There is a general rule, in concrete construction, that no aggregate (pebbles or broken stones) should exceed in size one-half the wall thickness in which it is to be used.

However, 1½ in. is fixed as the maximum for most work, while in thin walls, where reinforcing must be surrounded perfectly, it is often advisable to use a smaller size. In the case of fence posts, the limit of size is usually ¾ in., as the space to be filled in with concrete is small. For much foundation work it is permissible to exceed the 1½-in. maximum, but even in this, it should seldom be over 2 in., except in the case of very massive foundations or footings.

Saving Time in Tapping

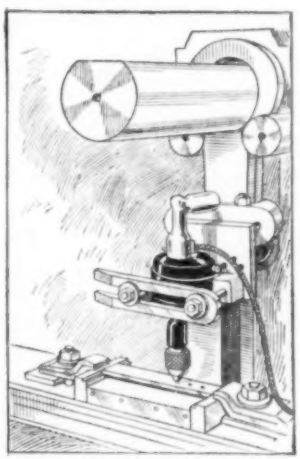
It is a well-recognized fact that a great amount of time is lost when reversing a tap after it has completed its work of cutting a thread, and this is particularly true when the holes are deep. The drawing shows how one mechanic reduced the time of a tapping operation of this character. The holes were quite deep, but, instead of reversing the tap, he allowed it to go right through, using a quick-acting chuck that released as soon as it was gripped. A rubber sheet was placed on the drill-press table, so that when the taps dropped, the edges would not be injured in any way. Of course a separate tap was used for each hole, and after each piece was finished, the operator removed them and placed them in readiness for the next piece.



Drilling on the Milling Machine

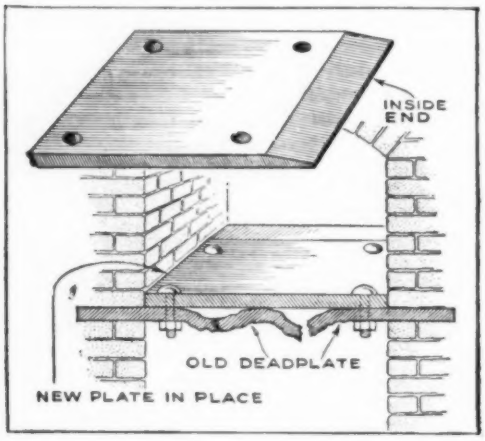
The drawing shows how a drilling job that demanded considerable accuracy, was worked out by a machinist with the assistance of a small electric drill mounted on the overarm of a milling machine.

The work involved the drilling of a number of small holes very close together. The job was clamped to the table of the machine, the holes being lined up with the drill by moving the table horizontally, while the drill was fed into the work by raising the table vertically by means of the handwheel. In a similar manner, such operations as reaming and tapping can be performed.



Repairing a Boiler Deadplate

When a new engineer came on the job, he found that the deadplates at the fire doors



How Repairs to Deadplates were Effected without Removing the Old and Damaged Plates

of his steam boilers were badly cracked and warped, and that they could not be taken out without the removal of a considerable amount of fire brick, which would make the job rather expensive.

Several cast-iron plates, the width of the fire door, the same length as the thickness of the brick wall, and 1 in. thick, were made and drilled with four bolt holes. It will be noticed that the inside edges of the plates were given a decided bevel so that there would be no difficulty in drawing the fire. These plates were bolted on top of the cracked and damaged deadplates in the manner shown in the drawing, making a repair that has been in use for several years. It is neither difficult nor expensive to make a pattern for casting such a plate.

Gilding Steel

Dissolve a quantity of gold in nitromuriatic acid, boiling until the acid has been entirely evaporated. The residue is dissolved in water, and three times as much sulphuric ether is added. The resulting solution is bottled and allowed to stand undisturbed for 24 hours to settle. If the steel, which previously should be entirely cleaned of dirt and grease, is dipped into the solution, it will immediately take on a thin coating of gold. By blocking out a suitable design with wax or varnish, any pattern can be produced in gold, with the steel showing in the parts thus protected.

Making a Smoke Screen

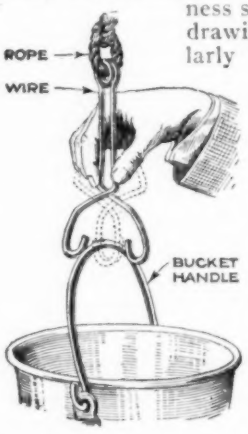
The secret of the compound known as the "B.M." mixture, used by the navy in the latter part of the war, in making a screen to hide the movements of ships, has just been made public.

The formula is: zinc, 34 parts; carbon tetrachloride, 41.6; sodium chlorate, 9.3; ammonium chloride 5.4, and magnesium carbonate, 8.3 parts. This was given the name B.M. mixture because it was originated by the Bureau of Mines, although later perfected by the Chemical Warfare Service.

The great value of this formula, from a military standpoint, lies in the very great amount of smoke produced by a very small quantity of the chemical. It is suggested, however, that it may also be useful in the arts of peace, and that fruit growers may find it of value during late spring frosts, when piles of brush are burned in the orchard.

Easily Operated Bucket Hook

A hook that does not suffer from the many disadvantages of the ordinary harness snap is shown in the drawing. It is particularly handy in cleaning cisterns, and for similar purposes. Steel wire, about ⅛-in. diameter, is the material used, and this is formed into a spring by taking two or three turns at the center around a mandrel, the projecting ends being bent as indicated. It is only necessary to push it down over the handle of the bucket to attach it, and a slight pressure of the fingers serves to open it when disengaging the bucket.—W. D. Gates, Clarksburg, W. Va.



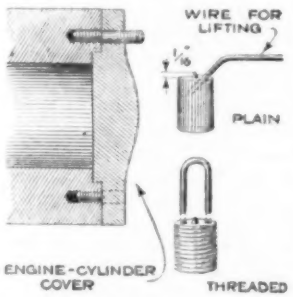
Protecting Store Awnings

Store awnings are short-lived at best, and their life is reduced by failure to protect them from contact with rain and snow when raised or rolled up. Consequently deterioration is rapid, and the awning speedily becomes discolored and an eyesore instead of a useful ornament.

Recognizing this, a store proprietor attached a suitable length of tin eaves trough to the building; the trough was inverted directly above the awning when in the raised or rolled-up position, with just enough clearance to prevent interference when raising or lowering. Thus rain, snow, or sleet cannot strike the awning and form pools of water to rot the fabric. This method of protecting the awning is inexpensive and will add greatly to its life, which means a considerable saving, especially in rainy climates. —Richard Newbecker, Tonawanda, N. Y.

Transferring Blind Holes

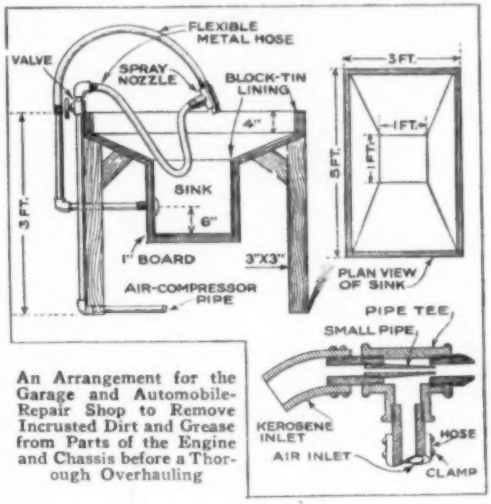
The drawing shows a method of transferring blind holes that has been used with good results. The job illustrated required a new cylinder head, and as the old head had not been sent along, it was necessary to transfer the 24 blind stud holes in the cylinder to the new head. These holes were found to deviate from a true circle and, moreover, were not equidistant, which made the task of marking the cover very awkward indeed. To save marking out and to get an accurate line, a ¾-in. stud was cut off about 1 in. long, chucked up true in the lathe, and a small "pip" center turned on one end, after which two small "tommy" holes were drilled and the piece was casehardened. This piece was screwed into one of the threaded holes of the cylinder until the center protruded about 1/32 in. above the surface, the new head was then laid on, tapped lightly with a hammer, the mark enlarged with an ordinary center punch, and the hole drilled. A stud was then threaded into the cylinder and this hole in the head was used to locate the others by moving the casehardened piece to each hole in turn, after which all the holes were drilled, the result being a very accurate line-up, the head fitting the 24 studs perfectly.



The same idea has been used in drilling plain holes, the only difference being that but one hole, and that at an angle, is drilled in the top of the center piece, so that a piece of wire can be inserted as shown in the upper detail drawing.

Stand for Washing Car Parts

The drawing shows the details of a kerosene washing apparatus, designed to facilitate the cleaning of dirty parts of the engine and chassis of an automobile prior to a general overhauling. To cut the dirt and grease by simply pouring kerosene over the parts, or by immersing them in kerosene, requires considerable time and, in addition, more or less brushing. However, kerosene applied under pressure will cut the dirt off rapidly.



An Arrangement for the Garage and Automobile-Repair Shop to Remove Incrusted Dirt and Grease from Parts of the Engine and Chassis before a Thorough Overhauling

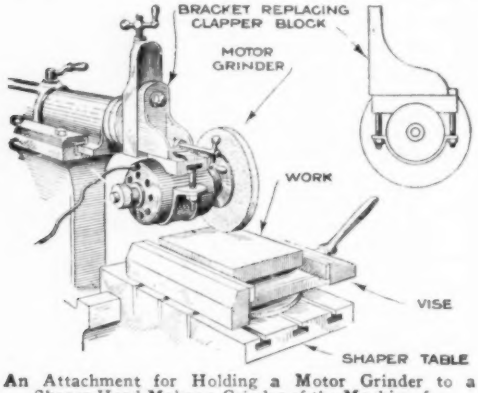
A drainboard with a catch sink, built along the lines indicated, will allow the parts to be placed so that they can be conveniently handled, and the kerosene and the dirt that is carried with it will drain back into the sink, to be used repeatedly, the dirt and other foreign matter gradually sinking into the sump below the suction pipe, where it is removed at intervals.

The details of the spray nozzle are clearly shown, and it can be made from standard fittings. A pipe line from the source of air pressure leads to a convenient position, and is fitted with a valve for regulating the flow of air. The oil feed is connected to the sink and provided with a screen, to prevent large particles of sediment from being sucked up and clogging the nozzle.

¶A good cement for joints on steam or water pipes, and one that will set under water, is composed of 4 lb. Paris white, ground; 10 lb. litharge, ground; ½ lb. yellow ocher, fine, and ½ oz. hemp, cut short. Mix well with linseed oil to a putty.

Shaper Used as Surface Grinder

A machine manufacturer has added the equipment shown in the drawing to his



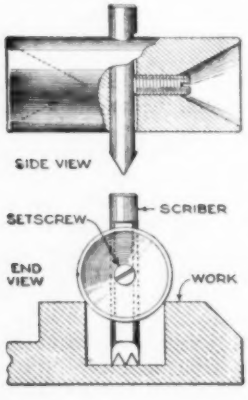
An Attachment for Holding a Motor Grinder to a Shaper Head Makes a Grinder of the Machine, for Surfacing Die Blocks and Similar Work

toolroom equipment for surface-grinding die blocks, plates, and parts that must seat accurately together.

The attachment is one of extreme simplicity and consists of a special bracket and clamp bolted to the ram in place of the clapper block. The clamp must be made to conform to the size and contour of the motor grinder used. The work is held in the vise, and the machine is operated in the usual manner, but at low speed, the grinding wheel cutting on both strokes of the ram.

A Slot-Center Scriber

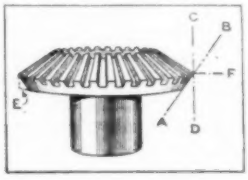
To draw accurately a central line down slotted work entails a good deal of preparatory work in the form of setting up the job, etc. Anyone having much work of this character to do, such as drilling holes in the centers of slots, milling, or other operations of a similar nature, will at once appreciate the usefulness of the extremely simple scriber illustrated.



A piece of 2-in. cold-rolled steel, about 3 or 4 in. long, is relieved at both ends to reduce the weight, a hole being drilled at right angles to the axis to take the ⅜-in. drill-rod scriber. One end is tapped for a ¼-in. setscrew that bears against a flat on one side of the scriber. The scriber is provided with three points, the purpose of which is obvious, although only the center line is ordinarily noted. In use, the tool is placed in the slot, as shown, the scriber pressed down and secured, and the device then slid along to mark the work.

Casting Bevel Gears

Bevel gears, as a rule, are cast with the periphery on an angle as at AB, the parting in the mold being at F. This method of casting leaves a fin, or rough edge, around the edge of the teeth. To overcome this trouble and the subsequent labor of finishing off the rough edge, gears of this type can be cast so that the face CD is vertical in the mold. In this manner the parting will be made at E, and little or no after work will be needed.—M. E. Duggan, Kenosha, Wis.



A Small Vise Used as a Fixture for Milling and Drilling

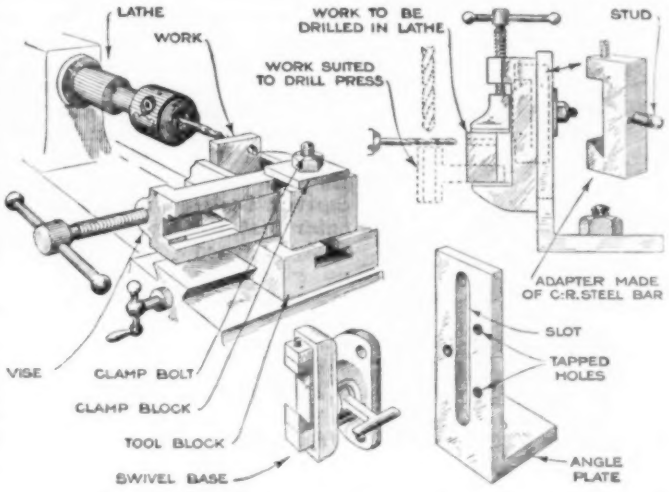
Low-priced vises, such as the type illustrated, are very popular for drilling and other work, and the drawing shows several simple fittings that greatly extend their range of usefulness.

One example shows an easily made clamp for holding the vise on its side on the tool block of a small lathe. By clamping the work in the vise jaws at a suitable height and then operating the cross slide, a series of parallel holes may be drilled at one setting of the work; or slots may be cut by an end mill held in the lathe chuck. The clamp consists of a bolt with a large head fitting into the tool-block T-slot, a plate, and a block the same height as the vise. Paper placed between the vise, tool block, and clamp plate will help to prevent the vise from slipping while in use. It is obvious that the vise may be swung around and clamped in any position, thus answering the purpose of an expensive milling attachment for a large variety of small work.

Another way to use the vise as a milling attachment, and which would also prove useful on the drill-press table for some awkward pieces of work, is to attach

it to a cast-iron angle plate, the upright side of which is slotted to permit adjustment of the vise up and down. An adapter will be necessary to clamp the vise to the plate, and one may be made by sawing and filing to shape a rectangular piece of cold-rolled steel bar. One end is drilled and tapped for the clamp setscrew, to hold the vise, and after completion it is a good idea to caseharden the adapter. A single stud through the center will probably be sufficient, though two may be used for a large vise. A fixture of this kind is similar to a conventional lathe milling attachment except for the vertical screw adjustment, and for many purposes will be just as satisfactory.

A convenient fixture for the drill press is made by bolting to an angle plate, by means of three capscrews or machine bolts, the swiveling bench stand provided for some of these vises. The vise can then be set and clamped at any angle, the angle plate being bolted to the drill-press table. Many pieces of work require holes to be drilled at some awkward angle, and a fixture of this kind will be found well adapted to work of this class.



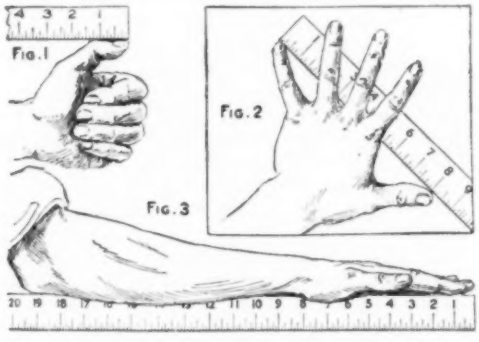
Several Arrangements by Means of Which Small Universal Vises can be Adapted to Hold Work for Operations in the Lathe, Milling Machine, and Drill Press

Measuring without a Rule

In a pinch, the hands, feet, and arms can be used as measuring "sticks" for making measurements that will be found surprisingly close in cases where accuracy is not essential.

The illustration shows how the thumb joint of the average man's hand indicates from 1⅛ to 1¼ in. In Fig. 2 we find that the average hand, outstretched, will come very close to being 8¼ in., and Fig. 3 shows that the average masculine forearm, from the point of the elbow to the tip of the middle finger, is about 20 in.

Take an average step, or "pace," and it will be found to be about 3 ft., although this is subject to variation according to the stature.—J. H. Moore, Toronto, Ont.



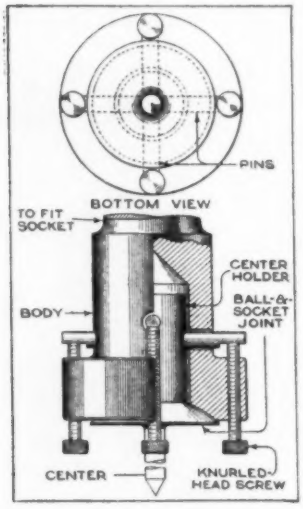
Members of the Body, Such as the Fingers, Hands, and Arms can be Used for Taking Approximate Measurements

Imitating Ebony on Birch

By a very simple treatment, birch can be made to imitate ebony very closely. A boiling solution is made of 2 oz. of logwood extract in 1 gal. of water, to which 1 oz. of sulphite of iron has been added. This preparation is applied to the work boiling hot and results in an intensely black finish. After the black stain has thoroughly dried, the wood is well sanded and rubbed with raw linseed oil, thinned with one-third its volume of turpentine. This application is allowed to dry overnight, and ivory drop black, ground in oil, is rubbed into the wood. After this has been allowed to dry for about 12 hours, the finish is completed by an application of black wax.—A. C. Cole, Chicago, Ill.

A Milling-Machine Indicator

To indicate the center-punch marks in work to be machined on a milling machine, it is necessary to have a center that is perfectly true with the spindle of the machine. The drawing shows a novel center indicator that can easily be trued up when it is transferred from one machine to another.

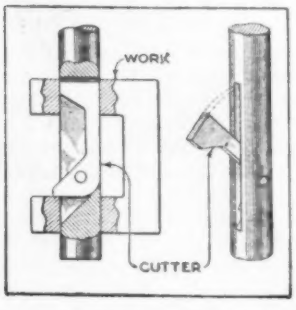


The body, made to fit the spindle, is turned from 2-in. stock, drilled with a ¾-in. hole, and a socket turned at the forward end to take the movable center. This body is also drilled and tapped to take the four adjusting screws, and is drilled for the two pins driven into the center, the holes being 1/16 in. larger than the diameter of the pins.

The method of using this indicator is almost obvious, the screws being adjusted in or out to swivel the center and thereby bring the point truly in line with the machine spindle. If the punch mark in the work is now lined up with this point, the hole or slot to be machined will be exactly in line.

Counterboring Tool for Inside Faces

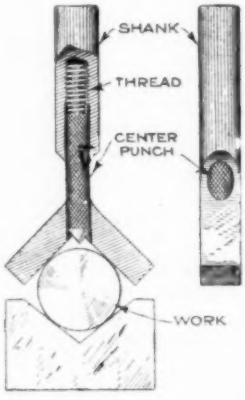
In counterboring an inside face on a piece of work similar to that illustrated, the operation is usually done by using inserted-cutter tools, the cutter being removed after the job is finished in order to permit withdrawal of the tool bar. With the tool illustrated, this is unnecessary, and moreover, there is no need of stopping the machine when withdrawing the bar, as centrifugal force will keep the cutter in the position shown at the right, when clear of the work.



The bar is slotted rather longer than usual, and the bottom end is finished at an angle, upon which the cutter bears when free. The cutter is made in the form shown, the upper and lower edges being rounded to the radius of the bar, the bottom face, of course, being relieved. The cutter is pivoted to the bar as indicated, and it will be clearly seen that its shape compels it to take an upright position as the bar is advanced, the top part and the pin taking the thrust while cutting.

A Shaft-Centering Gauge

The device shown in the drawing will be found very convenient for prick punching a shaft or other round stock that is to be drilled, with the assurance that after the drilling has been properly done the hole will be exactly through the center.



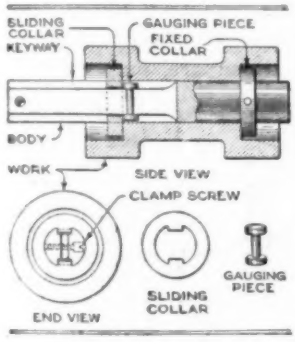
The V-piece is made from a piece of ⅜ by ¾-in. stock, split at one end to form the "V." The shank is then turned down to ⅜-in. diameter, gripped in the chuck to run dead true, and the center is bored out to clear ¼-in. rod, the back end being bored to ¼-in. tapping size. The shank is cut away on opposite sides, as indicated, and a punch is made to fit the hole. The punch is threaded at its upper end, the remainder of its length being knurled.

When the work is bolted to the drill-press table, the gauge is gripped in the chuck or made to fit a socket and brought down to touch the work with the punch screwed up out of the way. The stock is adjusted to the proper position by moving the table until both sides of the gauge touch it. The spindle of the machine is then raised a little, and the punch is screwed down with the fingers, when one or two raps with the spindle lever marks the center. The gauge is then removed, the drill inserted in its place, and the hole drilled exactly in line with the spindle, and through the center.

Gauge for Internal Shoulders

A novel form of gauge for measuring the length of work, in positions otherwise difficult to get at, is illustrated as applied to work having two internal shoulders that are required to be a definite distance apart.

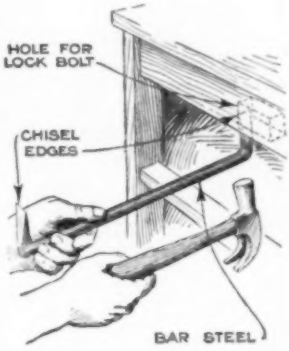
The body fits the bore of the work, although this is not particularly necessary. This part of the gauge has two slots, or keyways, milled at opposite sides, after which it is sawed or milled in two for the length of the slots. The fixed collar is next pinned to the body, and a sliding collar, as shown, is made for the opposite end. A piece of drill rod is turned to a slightly smaller diameter at its center than the width of the saw cut, and with each end a sliding fit in the keyways; this forms the gauging piece. The gauge is completed by drilling and tapping a hole near the end of the body for a screw, that passes through both halves and clamps the gauging piece in the proper location, pinching it between the walls of the slot when the screw is tightened.



To use the gauge, it is inserted into the work, the sliding collar being removed until the fixed collar strikes against the shoulder of the work. The collar is then slipped over the end and moved along, pushing with it the gauging piece, until the collar comes into contact with the opposite shoulder of the work. Then, with both collars in snug contact against the shoulders of the work, the screw is tightened a little, to clamp the gauging piece in place. The gauge is then pulled out and the sliding collar replaced and pushed up into contact with the gauging piece again, when, of course, the distance of the inner faces of the collars will be the same as the shoulders of the work. This distance can then be measured with ordinary calipers, or if more accurate results are desired, with an inside micrometer or vernier caliper. The same gauge will, of course, be useful in many different sizes and lengths of work, and will be just as accurate if only one side of each of the two collars touches the work.

Special Chisel for Lock Fitting

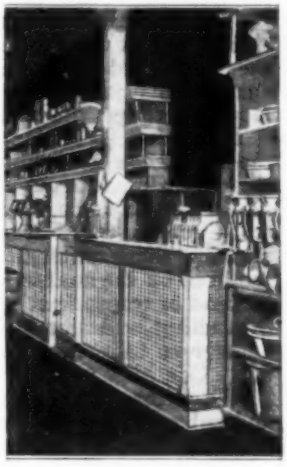
The drawing shows a chisel for the special purpose of setting in mortised locks or making holes for the lock bolt in cabinets, desks, and other places where space is too cramped to permit the use of the ordinary hammer and chisel.



The chisel is made from a 15-in. bar of tool or drill steel, the ends of which are bent at right angles to the body. A blade is forged on one end with the edge parallel with the body, the one on the opposite end being made at right angles. In use, the tool is held in the hand, near the outer end, and the chisel is struck with the hammer as close to the cutting blade as possible.—G. A. Luers, Washington, D. C.

Screen Counter Panels Prevent Drafts

The employes of stores frequently complain of cold feet, and cold drafts around the feet, when engaged behind counters. This condition is a common one, and is caused by the counters shutting off the warm air. The photograph shows how conditions of this character were satisfactorily dealt with in one establishment.



The ordinary wooden counter panels were removed and the openings covered with wire screen, painted to correspond with the rest of the woodwork. Now the air passes freely through the counter partitions, so that all parts of the store are uniformly heated.—Chas. A. Goddard, Los Angeles, Calif.

Special Truck for Handling Crankshafts

The photograph shows a specially designed truck that is used by a manufacturer of small lighting plants for transporting crankshafts to various parts of the factory.

A Special Truck for the Transportation of Crankshafts Results in Ease of Handling and Minimum Liability of Damage to the Finely Machined Surfaces; the Truck is Built of Structural Steel and Holds 80 Pieces

The truck is made of structural steel, with wooden strips against which the shafts rest, and the construction is sufficiently rugged to withstand usual shop conditions. One set of wheels is of the swivel type and has ball bearings, the other set being rigid. The lower wood strip of each row has holes bored in it, into which one end of the crankshaft fits, and the upper strip has slots. Both holes and slots are made large enough to accommodate the rough forgings, although the same truck is used for the finished product. An angle-iron strip, running across the upper ends of the shafts, hooks over lugs at each end of the truck, and holds each row of crankshafts from jarring out as the truck is moved through the factory.

The truck is loaded with forgings at the raw-stock department and goes with the crankshafts through all the operations performed on them. After inspection, the truck goes to the finished-parts stock and remains there until the crankshafts are required on the final-assembly track. This method of transportation eliminates much rehandling and putting into stock bins, damage to finished surfaces, and recounting. Counting can be done at a glance, as the vacant spaces need only be noted and subtracted from the full load, which is 80 pieces. The orderly manner in which the work comes to the workman suggests care and order to him, with a separate compartment for each piece, and he is assured that no damage can result to the finished surfaces in transportation, and thus he is certain that no scrap is charged against him. — E. H. Tingley, Dayton, Ohio.

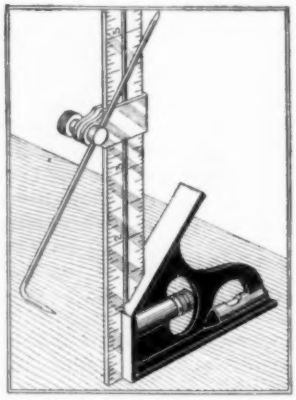
Saving Time When Polishing Nuts

A lot of 2,000 nuts had to be polished in a limited time; several hundred had already been polished by screwing each piece onto a shouldered stud used as a holder, when one of the polishers adopted a method which increased his production from 600 a day to as many in two hours.

He used a brass rod, 3 ft. long, on which he strung the nuts. A short thread was cut on each end and smaller nuts were provided to fit. About a hundred of the unpolished nuts were slid onto this rod, and the end nuts were drawn up to hold them solidly in place. The assembly was then held against the buffer and polished as though it had been a solid bar.—H. S. Trecartin, Wakefield, Mass.

Surface-Gauge Attachment for Square

An adjustable square of the type shown, or an ordinary try-square, may easily be converted into a handy surface gauge by means of a simple attachment. All that is required is a piece of thin steel, about 1/16 by 1 by 4 in. long. This is formed into a clamp that fits around the scale of the square, and is fitted with a binding screw for clamping it in position, and with a scriber. An attachment of this kind saves the cost of a regular surface gauge and is just as satisfactory.



Pocket Flashlight Put to Odd Uses

Once, while on a solitary fishing trip, my supply of matches gave out. I removed the battery from my flashlight and failed in an attempt to obtain a spark by short-circuiting the terminals because the voltage was not high enough. In my tackle box I had about 25 ft. of small, insulated wire, and I wound this as evenly as possible onto one end of an oarlock, although a nail, bolt, screwdriver, or any similar article would have answered. With this improvised impedance coil connected to the two terminals of the bat-

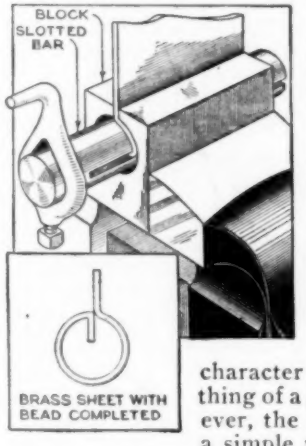
tery, I was able, by making and breaking the circuit, to obtain a spark sufficiently large to ignite a piece of tissue paper taken from a cigarette.

On another fishing trip, a companion accidentally dropped a much-valued artificial bait overboard. It was made of steel and immediately sank to the bottom.. We improvised an electromagnet from the same piece of insulated wire wound on a small bolt. The ends of the wire were left long enough to reach to the bottom of the stream and connected to the flashlight battery. The magnet was lowered into the water and, after dragging it around the spot where the bait had disappeared, we caught it and drew it safely to the surface.

This last adventure was hard on the battery, as it refused to light the lamp afterward, but the satisfaction of recovering the bait more than offset this.—C. M. Crouch, Minneapolis, Minn.

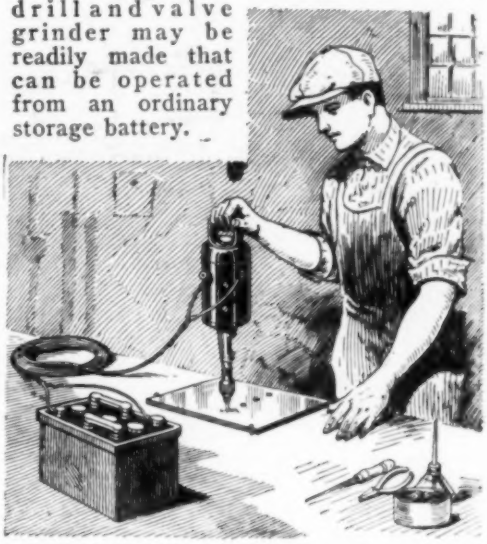
Beading Tool for Sheet Metal

One of the jobs common to sheet-metal workers consists in turning over the edges of a piece of metal to form what is commonly known as a "beading." Of course, being equipped with the necessary tools, this is a very simple matter, but in the machine shop and on the casual job, work of this character presents something of a problem. However, the drawing shows a simple method of rolling or beading sheet-metal edges. A die was made of a steel block having a hole drilled to the diameter of the bead and slotted to permit insertion of the work. A piece of round bar, sufficiently large to provide clearance for the sheet metal, was slotted. In use, the slotted bar was placed in the die block, and the sheet metal inserted into the slot in the former. A lathe dog or pipe wrench on the end of the bar is used to provide leverage for turning it and forming the bead. The inner edges of the slot should be rounded slightly and the work lubricated with lard oil.



Electric Drill Made from Old Starting Motor

Almost every garage and repair shop has at least one old starting motor lying around the place, from which an electric drill and valve grinder may be readily made that can be operated from an ordinary storage battery.

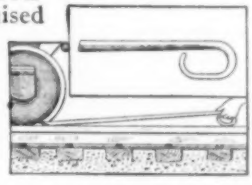


An Electric Drill Made from the Electric Starting Motor of an Old Automobile: Such a Drill can be Operated from an Ordinary Storage Battery and will be Found Invaluable in the Garage and Repair Shop

The motor shaft is cut off about 4 in. from the end of the motor, and the shank of a breast drill is dressed down to the same size, the drill chuck being held to the shaft with a tight-fitting sleeve of metal tubing, which is welded in place after both have been lined up. As there are many types of starting motors, the description given for the construction of a drill of this type can only be suggestive. —Denby Clark Stephenson, Augusta, Kansas.

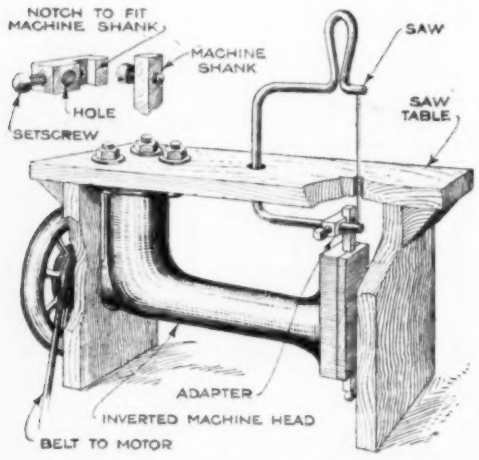
Pinch Bar Made Safe to Handle

A western railway, believing in safety-first methods of a practical kind that keep down compensation claims, prevents bruised and crushed fingers by furnishing its employes with pinch bars having an eye formed at the end. This eye prevents the bar from being lowered so much that the hand is brought into contact with rails and other solid materials that would result in injury to the hand of the user.



Jigsaw from Old Sewing Machine

The drawing shows how an old sewing machine was rigged up for driving an



A Jigsaw for Cutting Out Small Parts of Wooden Patterns That Makes Use of an Old Sewing-Machine Head and an Ordinary Coping Saw

ordinary hand coping-saw frame, and used for sawing out small parts of wooden patterns. All superfluous parts of the machine were discarded, including the table, vertical shaft, etc., leaving only the horizontal shaft, pulley, cam, and vertical reciprocating bar. The head was then bolted to a board that served as a saw table, and inverted. The saw frame was attached to the vertical bar, or machine shank, in this case a square one, by means of an adapter made of a piece of ½-in. square steel stock, with a notch filed for the shank and a ¼-in. hole drilled to take the saw frame, which was held in place by a setscrew tapped into the end of the adapter. An 8-32 machine screw fastened the adapter to the shank. As the saw operated with a draw cut, it was placed in the frame with the teeth pointing down, the handle of the frame being up. Holes were bored in the table to take the saw frame and saw.

In use, the table, provided with vertical sides to allow the machine head to clear the bench to which the device was bolted, was driven by a ⅛-hp. electric motor, belted to the regular drive pulley on the machine head, but as the work is light, a foot-power drive would be perfectly practicable.

¶Two coats of paint, well brushed out and not too heavy, will wear better than two heavy coats, not brushed out.

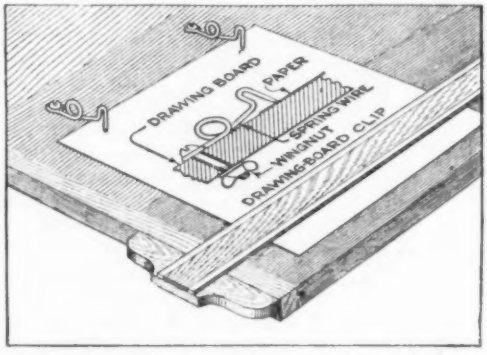
Sharpening Glass-Cutter Wheels

The hardened-steel wheels of glass cutters can be sharpened without removing from the handle, in the following manner: Hold the cutter against an emery wheel so that an angular face of the former is parallel with the grinding wheel. The handle will be ground away at the point far enough to bring the cutter into contact with the emery wheel, but this will not weaken it, as, when cutting glass, pressure is applied to it from the opposite direction. After rough-grinding the cutter it should be held in contact with a wet grindstone to insure a smooth, fine edge. Caution should be used in the rough-grinding operation. Dip the cutter in cold water frequently to prevent it from getting too hot and losing the temper. The cutter will revolve when it comes in contact with the grinding wheel and will be ground evenly.—Edwin J. Bachman, Fullerton, Pa.

Clips for Small Drawings

Where a detail draftsman works continually on drawings of the same size, his drawing board becomes so "punctured" at the points where the thumbtacks are inserted that they will not hold.

For such work the clips illustrated have been found to be very efficient and con-



Spring-Wire Clips Attached to the Draftsman's Drawing Board Are a Convenient and Satisfactory Substitute for Thumbtacks on Drawings of Uniform Size

venient, but are, of course, applicable only to small drawings. However, as most drafting rooms are adopting standard sizes for their detail parts, the clips can be used in most cases.

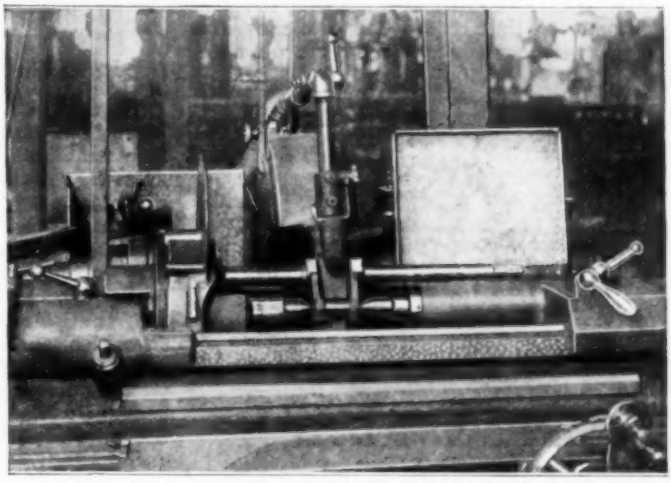
Spring wire is used in forming the clips, which are bent to the form shown, attachment being made to the drawing board with small machine screws and wingnuts.—J. H. Kay, Cleveland, Ohio.

Grinding Crankpins

A special fixture and method for grinding the crankpins used in his product by a manufacturer of small direct-connected lighting plants, is shown in the photograph.

The standard 10 by 24-in. grinder has a fixture equipped with a live and a dead center. Around the live center is a casting, having a recess in which one end of the crankshaft rests, and a driving lug acts on the cheek of the shaft to cause rotation. A grinding wheel of the proper width is used, and kept dressed square with the line of the centers. The wheel is brought up to the work, and, in one operation, the crankpin is ground to the required dimensions, and the length of bearing maintained within the permissible limits. This method of grinding produces finished crankpins within .001 in. on diameters, and within .005 in. on the length of the bearing. The allowance of .0005 in. for taper in the bearing is never exceeded if care is used in dressing the wheel. The crankshaft forgings have been previously centered and rough-turned before coming to the grinding operations, and the same method and type of fixture is used for both rough and finish-grinding.

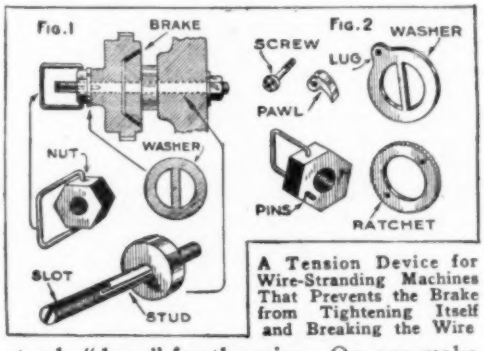
As a precaution against inaccuracies, a hardened steel ring has been shrunk around the casting holding the live center; this is supported in a bearing and acts as a steady rest. The ring is placed close to the driving center for maximum effect, and this larger bearing permits closer adjustment than would be possible with a plain center. Much time and the expense of grinding wheels have been saved by the adoption of this method.



A Grinding Fixture for Rough and Finish-Grinding on Crankpins That Produces Work within the Required Limits Speedily, Accurately, and at Minimum Cost per Piece

Tension Regulator for Wire Stranding

On a stranding machine for twisting wire cables, it is necessary to keep a tension on the winding spool, to provide a steady "draw" for the wire. On one make of machine this tension is provided by a conical brake, driven from the winding yoke through gearing. In order that the nut may not be drawn up too tight by the rotation of the brake, a special washer, shaped as shown in Fig. 1, is used. The bar across the center of the hole fits in a slot milled in the stud, preventing the washer from rotating and from drawing the nut hard against the brake.

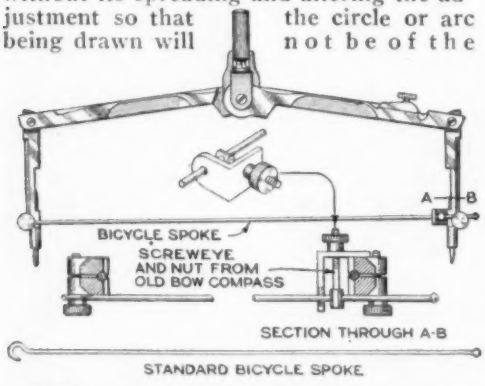


A Tension Device for Wire-Stranding Machines That Prevents the Brake from Tightening Itself and Breaking the Wire

It was found on some machines that the vibration would loosen the nut allowing the winding spool to "run away" and break the wire; this was prevented by using the nut and washer illustrated in Fig. 2. The nut was provided with two pins, fitting into holes drilled in a ratchet wheel of the same diameter as the washer. The washer was made with a lug to hold a small pawl. Ratchet, pawl, and washer were casehardened. When the washer was in place, the nut and ratchet were screwed on the stud, the pawl preventing any backward movement of the nut.

Stiffening the Draftsman's Compass

Every draftsman knows how hard it is to use a compass in the manner shown, without its spreading and altering the adjustment so that the circle or arc being drawn will not be of the

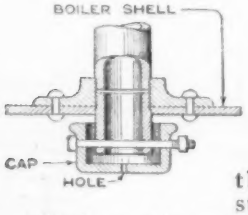


A Stiffening Attachment for the Draftsman's Compass That Holds the Instrument Always to the Adjustment for Which It is Set

radius to which it was set. The drawing shows an easily made clamp and stiffening bar that can be used on the compass to hold it firmly in the position to which it is extended. A bicycle spoke is flattened slightly at one end and a hook is formed to fit around the screw as shown. A small L-shaped clamp, and the screw-eye and nut from an old bow compass are used to complete the attachment. A hole is drilled in one angle of the clamp, through which the bicycle spoke passes, and another hole is drilled in the other side for the accommodation of the screw-eye and nut. The compass is not altered in any way, and the brace and clamp are applied to it as shown, with the hook applied over one of the binding screws, the bicycle spoke bearing against one side of the compass leg and the clamp against the opposite side.—Clare B. Smith, Chicago, Illinois.

Preventing Priming of Small Boilers

Various methods have been applied to check and prevent priming in small steam boilers, but the plan illustrated in the drawing is one of the simplest that has been successfully used.



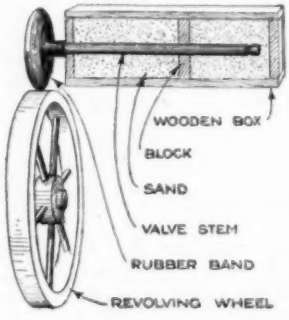
A short nipple, the size of the steam-outlet pipe, is drilled to take a bolt from which is suspended an iron pipe cap, two sizes larger than the diameter of the nipple. A small hole is drilled through the center of the cap to allow condensate to drip back into the boiler.—James E. Noble, Portsmouth, Ont.

Protecting Holes When Welding

When welding broken castings, or other parts, the metal almost invariably flows into machined and threaded holes to such an extent that the work has to be rebored or retapped when the weld is completed. When suitable facilities for such machine work are not available, the welding metal can be prevented from entering these places by the use of carbon rods fitted into the holes. Because of the high heat to which carbon can be subjected without in any way changing its form, the welding flame does not affect it, and consequently the molten metal with which the weld is filled can only flow around the carbon rod, without entering the hole.

Polishing Valve Stems

Rough, rusted, and sticking valve stems make the motor irregular and expensive in operation; the burnt gases and carbon deposit attack and corrode the stems, and unless these are occasionally cleaned, trouble can usually be expected from this source. A simple device for polishing the valve stems consists of a box filled with sand; the stem is inserted through a hole in the cover, and the valve turned by pressing the valve head against a revolving wheel. A rubber band, about ½ in. wide, is stretched over the edge of the valve head to form a friction surface. The operation is much quicker than placing the valve in a lathe or vise and polishing with emery cloth, and as there is no danger of springing the stem, which would make the valve bind, it is the safest and quickest method of doing this work. The sand, or it may be emery powder, in the box should be perfectly dry, so that it will always press against the valve stem.—G. G. McVicker, North Bend, Neb.

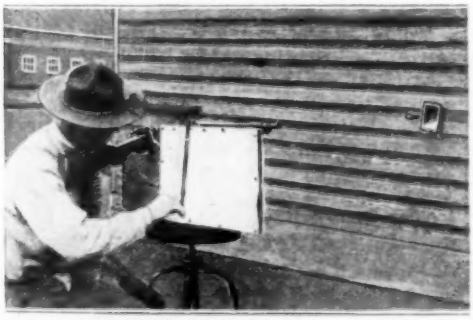


Amateur Mechanics
Information as to where to obtain any specified materials or parts for making objects described in the following pages may be had, on request, from our Bureau of Information.—Editor.

Testing One's Rifle-Sighting Ability

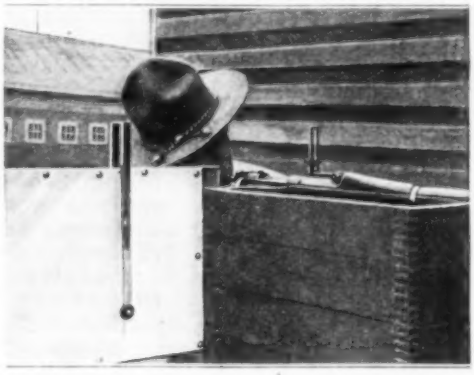
By CAPT. C. E. CROSSMAN, U. S. A.

A PART of the primary instruction of a rifleman in the army is the making of "triangles." This constitutes a test of the rifleman's ability to sight his rifle uniformly for each shot. In the usual method, the rifle is held in notches in an empty cartridge box so that it remains motionless while the student looks through the sights. At the "target," which may be at any distance up to 200 yd., an assistant holds a black bull's-eye, proportionate in size to the distance, against a white background, the bull's-eye being fastened to a rod or stick. The student looks through the sights, without moving the rifle, and, through another assistant, tells the man at the bull's-eye which way to move it, until the front sight just "touches" it. He then tells the assistant, who signals "mark" to the man at the target, and he, in turn, without moving the target, pushes the point of a pencil through a hole in the center of the bull's-eye, making a mark on the white ground. The target is then moved so that it does not coincide with the sights, and the student repeats the performance, taking care not to move the rifle, and a second mark is made on the white background.



Rifleman's Side of Screen, Showing How the Bull's-Eye is Moved and the Paper Screen Marked

When three such dots have been made they are connected by lines, forming a triangle, the size of which indicates the student's uniformity of sighting, and, consequently, his ability to shoot accurately. The shape of the triangle indicates which way the error of the student lies. If it is too high, he is not "holding elevation," that is, not getting the bull's-eye in just the right vertical relation to the front sight each time; if too wide horizontally, he is not getting the bull's-eye directly over the front sight.



Front View of Sighting Frame and Screen, Showing the Bull's-Eye

The process of sighting and moving the target is a very tedious one, and one that is not always productive of the best results, as the success of the method depends, to a large extent, upon the patience of the men. Very often the rifleman, in despair, will say, "Oh, that's good enough," when, as a matter of fact, the position of the target does not quite suit him. An army officer, however, has worked out a method that eliminates this drawback, and enables the recruit to make his own triangles.

The rifle is arranged as in the old method, but to the right of the box is a frame carrying a white-paper screen. A piece of flat iron straddles the screen, and is pivoted to the frame; one end of the iron carries a small bull's-eye, the other, next the shooter, a little fine-pointed punch. A mirror, set up at a convenient distance—about 20 ft.—is arranged so as

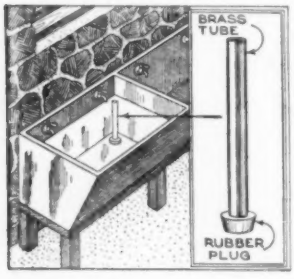
to reflect the image of the bull's-eye to the rifleman as he sights the rifle. Reaching over with his right hand, he moves the bull's-eye until the image in the mirror is just over the front sight, then a slight pressure on the iron causes the punch to make a tiny hole in the screen.

The bull's-eye is then swung a little distance, the student sights again, and moves the bull's-eye until it is again over the sight; then makes another mark. When three marks have been made, the triangle is drawn. If all "shots" have been sighted exactly alike, there will be but one hole in the screen.

This arrangement will be of great assistance to the amateur rifleman, as by its aid he may determine what his most common faults in sighting are, and be able to correct them without depending upon the more or less uncertain results of common target practice and observation.

An Overflow Drain Stopper

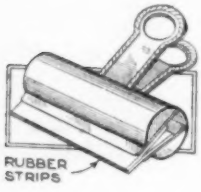
When using a water-power clothes-washing machine, allowing the machine to discharge the water into a stationary laundry tub, a drain stopper of the type shown will be found a highly desirable accessory.



A short piece of metal tubing is inserted into a hole made through the regulation rubber stopper, the height of the tubing being the same as that of the water level it is desired to maintain in the tub; the excess water runs off through the top of the tube and eliminates the possibility of overflowing the tub. This arrangement makes it possible for the laundress to use the tub for rinsing, the suds that rise to the top being drawn into the overflow pipe and carried away so that the water is sufficiently clean for an extra rinse if desired.—Mrs. H. A. Trester, Milwaukee, Wis.

Squeegee for Small Windows

When washing the many small lights of glass in the windows of modern homes, it is generally found that the regular-size squeegee, or rubber wiper, is far too large to be of any use.



A good substitute can easily be made by cutting three or four strips, 1 in. wide and about 3½ in. long, from an old inner tube, and placing them in a spring paper clip in the manner shown in the drawing. On account of its small size, it can be easily carried in the pocket.

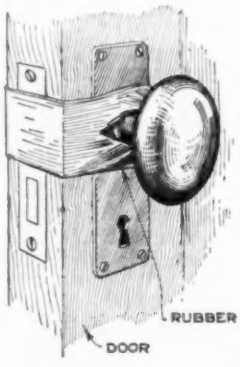
A Fountain-Pen Stamp Moistener

An old fountain pen from which the pen and feed have been removed, can be converted into a convenient moistener for stamps and envelopes.

A wick is inserted into the part from which the pen has been removed; the barrel is filled with water, and the device is ready for use. Such a moistener can be conveniently carried in the pocket.

Silencer for Doors

The latch on the door of a sickroom, the sharp click of which is sometimes a cause of much discomfort to nervous patients, can easily be muffled by a strip of rubber applied to the door in the manner indicated by the drawing.



The strip of rubber, which may be cut from an old inner tube, is provided with openings at the ends to slip over the door knobs on both sides of the door, covering the latch. By this means it is possible to open and close the door noiselessly without disturbing very wakeful patients.—Margaret A. Pohle, Franklin, N. H.

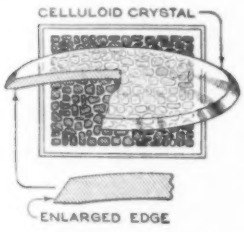
Greasing Wagon Wheels

Too many farm wagons have worn-out bearings, caused by lack of grease. Most of these bearings have been worn out prematurely because the usual practice is to wait until a squeak develops before lubricant is applied. In order to make the application of grease to the axles easy and frequent, each wheel can be equipped with a grease cup. Drill a ½-in.

hole through one side of each hub between two spokes, the hole being continued through the box, and threaded to take a short length of ½-in. pipe, inserted through the hub. It will be necessary to see that the end of the pipe is finished off so as to conform to the taper and radius of the skein. A spring-compression grease cup on the outer end of the pipe makes a constant supply of lubricant available, as, by releasing the thumbscrew of the grease cup, the lubricant is kept constantly pressing into the bearing. Aside from the fact that proper lubrication doubles the life of the bearing, the load is drawn much easier by the team.

Unbreakable Watch "Crystals"

An unbreakable watch "crystal," that saves the trouble and expense of taking the watch to a jeweler, can be easily made from a piece of celluloid; a pair of scissors and a sharp knife being the only tools required.



A piece of transparent celluloid, of the kind used for automobile curtains, is used, although material a little thicker is preferable. Mark off the size, using the bevel of the watch for a guide, by making a pencil mark around the inside where the glass fits. Then cut out the celluloid disk nearly up to the line, allowing a little extra material for fitting. Of course the celluloid disk will be a trifle large, but the proper size is obtained by scraping down the edge until it goes into the bezel with a snap. The edges of the disk must be made the same as crystals made of glass, which are shaped as shown in the drawing.

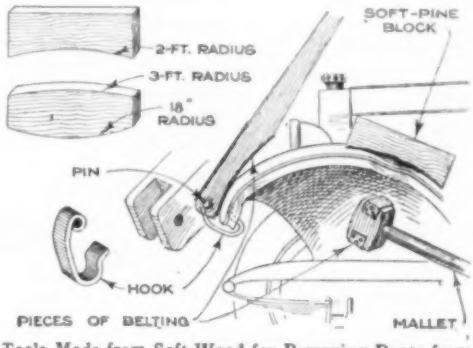
The celluloid disk can be made convex by steaming slightly and pressing it into shape on the back of the watchcase as it cools.—H. A. Hart, Shreveport, La.

Tailors' Thimbles Help Grip

For automobile repairs in tight places, where it is either impracticable or impossible to use pliers or wrench, a pair of tailors' thimbles, of the type that is open at the smaller end, slipped over the thumb and index finger, gives a viselike grip, while, as the finger tips are exposed, the operator retains his sense of touch.—Harold McMahon, Hatchville, Mass.

Tool for Removing Mudguard Dents

Three simple tools that are of special service in the garage or repair shop, for



Tools Made from Soft Wood for Removing Dents from Fenders and Bodies and for Straightening Fenders

restoring buckled and dented bodies and fenders, are shown in the drawing. The wooden mallet is faced with a section of heavy leather belting, and is used with the wooden supporting blocks, which are of soft pine. One block has a concave face while another is provided with convex faces of different radii. Various other sizes and shapes may be easily made to meet special cases.

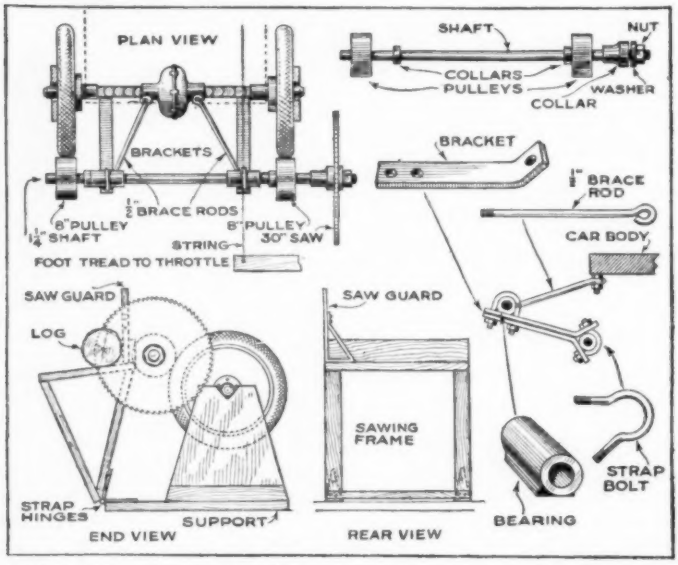
A lever, about 6 ft. long, is made with its lower face concave and is faced with leather or rubber. The end of this lever is provided with a hook that engages underneath a buckled fender in the manner shown, so that the fender will be restored to nearly its original shape.

Horseshoe Pads Made of Old Auto Tires

A good rubber horseshoe pad can be made from disused automobile-tire casings. A section of the tire, where the rubber is thickest, is cut to the size and shape of the animal's foot. The rubber is then cut away to the fabric, following the contour of the shoe, the latter being cut a trifle short to allow for a cushion at the heel. Pads of this sort are useful for preventing injuries to the frog or for retaining oakum packing or other curative dressings.—F. H. M. Dunseith, Scranton, Pa.

Saw Driven by an Automobile

A comparatively simple arrangement for operating a circular saw, for cutting up cordwood, and for similar purposes, can be operated by any automobile. A 1¼-in. shaft, having two 8-in. pulleys permanently attached and spaced such a distance apart as to line up with the rear wheels of the car, is attached to the rear axle by two wrought-iron brackets provided with bearings.



A Simple Arrangement to Enable the Auto to be Used as a Driving Medium for a Circular Saw: No Alterations are Made to the Car, and the Device may be Attached or Detached in a Very Short Time and No Belt Is Necessary as It Has a Friction Drive

The shaft bearings are secured with strap or U-bolts, passing through slots so as to permit moving the pulleys back or forth, as may be desired. The right end of the shaft is fitted with a collar and thread for mounting a circular saw of about 24-in. diameter. From each bracket a ½-in. round rod runs to the spring supports of the car to give additional rigidity. The engine is controlled from the rear of the car by a cord attached to the throttle on the carburetor, a spring being attached to the throttle to keep it normally closed, or at normal speed. This is to prevent racing of the motor.

The saw table is of the swinging type, with an extension on which is placed the vertical supports onto which the car is jacked. This arrangement keeps the table steady and in line with the saw. In use, the car is driven to the scene of operations, the rear wheels are jacked up and let down on the supports, the brackets and braces attached, and the bearings adjusted so that the pulleys will be in contact with the tires.

Such an outfit can be made up very simply, as no belt is needed, and the materials required are quite generally obtainable at slight cost.

Diffused-Focus Photographs

To get the "soft" photographic effects that are deservedly popular, a proper soft-focus lens should be used, although there are various ways to obtain this effect either in the negative or in making the print. One advantage of diffused-focus prints is that undesirable freckles and similar blemishes are not so conspicuous, and retouching is entirely eliminated, or, at least, the amount necessary is greatly reduced.

One method of obtaining this result is deliberately to make the negative out of focus. In other words, focus the camera sharply on the subject, and then move the lens just a trifle back or forward. A similar effect can also be obtained by reversing the ground glass in the focusing screen, so that the rough side is out, and then focusing sharply, making the exposure in the usual manner, or the plate may be placed in the holder with the sensitized side away from the lens. Another method that gives better results than any of the foregoing but requires a somewhat longer exposure, is to tie one or more thicknesses of chiffon over the lens after sharply focusing on the subject.

If it is desired that the negative be as sharp as possible and show every bit of detail, the resulting prints can be softened by placing a piece of clear glass or celluloid between the sensitized paper and the negative; the thicker the material used, the greater the diffusion. Very attractive results can also be obtained by interposing a piece of chiffon, or some similar gauzy material, between negative and paper; the best results by this means are to be had on large prints. As stated above, a real diffused-focus lens should be used to get the finest results.

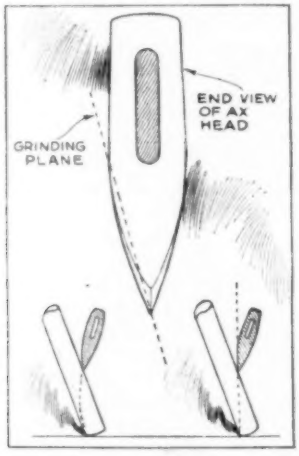
Preventing Flapping Window Shades

It is often desired to have a window shade partly or entirely drawn when a draft from an adjacent window or door would cause damage or annoyance by flapping it. This trouble may be avoided by placing a small hook in the center of the lower sash, with the hook pointing down, to hold the ring with which most shades are provided.

In placing the hook, draw down the shade until the ring can be slipped over the hook, while the roller catch is not in action, allowing the tension of the roller spring to pull against the ring and hook. This method will hold the shade flat and quiet in a very considerable draft. The tension of the spring may be increased if necessary.

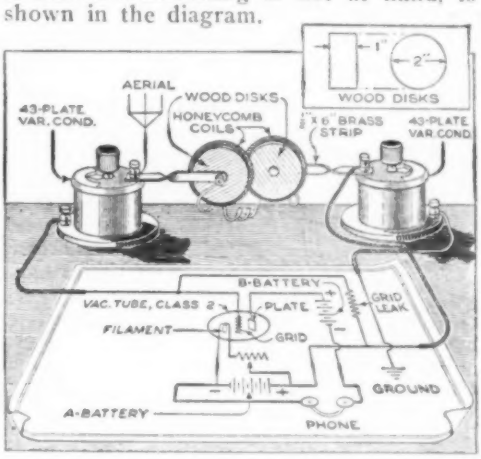
Sharpening Stakes with a Hatchet

When sharpening the ends of stakes, bean poles, and similar sticks that are to be inserted or driven into the earth, many strokes of the hatchet or ax used for sharpening the point are usually needed to get a satisfactory point. All this trouble and extra work may be entirely overcome by sharpening the hatchet or ax properly. When grinding the blade, one side and then the other is usually brought against the grindstone to produce a bevel on both sides, as in the left-hand illustration. Instead of doing this, allow one side of the blade to lie nearly flat against the stone, then put a bevel on the opposite edge in the usual manner, to give the edge shown in the right-hand view. When pointing stakes, the flat surface must be the one nearest the wood. The blade will be found to enter quite easily instead of glancing off, and the resulting cut will be straight, as indicated by the dotted line, thus saving quite a lot of energy and producing much neater work.—Edward S. Perrin, Girard, Illinois.



Combining Detector and Amplifiers

A handy way to mount honeycomb coils, for testing in a receiving circuit, if a standard mounting is not at hand, is shown in the diagram.

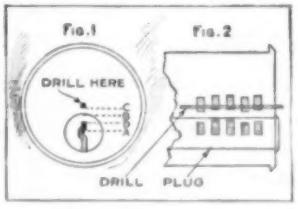


A Simple and Quickly Adjusted Emergency Mounting for Honeycomb Coils: This Method may also be Used in Constructing a Wave Meter

Two thin strips of spring brass, ½ by 6 in., are drilled at each end and given a quarter-twist; these are placed under the binding posts of standard-type variable condensers of .001-microfarad capacity. The coils are mounted on wooden disks, 1 in. thick by 2 in. in diameter, drilled at the center to take a small binding post that holds both the lead wire and the brass strip. By moving the condensers, any degree of tuning is possible. The same idea for mounting a coil on the condenser is very handy for use as a wave meter, but in this case, the coil must be of known inductance, and the condenser of exactly .001-microfarad capacity, placed in series with a battery, key, and buzzer.

Opening Cylinder Locks

The highest type of cylinder lock, which is practically proof against picking, can be opened without impairing the usefulness of the lock or beating down the door.

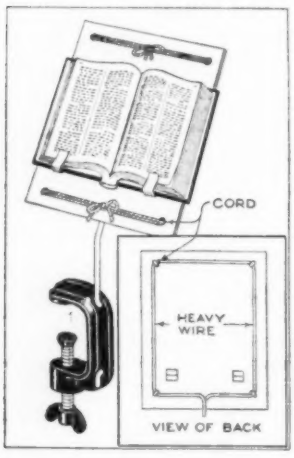


Measure from the bottom of the pins visible in the lock at A to the junction of the plug and cylinder B, allowing for the shoulder on the plug. This gives the

length of the longest pin. Transfer this distance to the face of the lock directly above the pins at C, measuring from the top of the key slot D. Insert a blank key that fits the lock and drill a small hole, with a No. 60 or smaller drill, at a point slightly above C. Run the drill carefully through all the pins and leave it sticking in them, all of the upper halves of the pins being held on the drill as indicated. When the blank key is taken out the lower pins will drop free, allowing the lock to be turned open. The hole in the face, neatly plugged, is not noticeable.

A Handy Book Rest

A book rest that can be conveniently and quickly attached to the arm of a chair or the edge of a table requires nothing more than a small iron clamp, a few feet of heavy wire, and a piece of stiff cardboard or wallboard.



The 8 by 10-in. wallboard book support is punched at each corner, 1 in. from the edge. The wire is bent to a rectangular shape, a little smaller than the back of the card, and is fastened in place with cords drawn through the holes. A 7 or 8-in. length of wire is left for attachment to the clamp, in which two holes are drilled as indicated in the drawing, the wire being passed through these and fastened. The jaws of the clamp are prevented from marring the finish of the furniture by pieces of felt or rubber glued to them. Two tin strips, ½ in. wide, are doubled and bent at right angles; the ends are inserted through slots cut near the bottom of the book holder, spread to hold them fast, and the other end of the doubled strips is bent to form clips for supporting the book.—Mrs. R. D. Shultis, Lansing, Mich.

Waterproofing Laboratory Woodwork

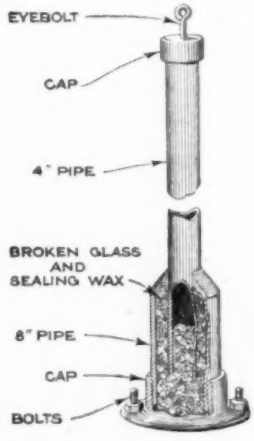
When chemicals are spilled on the tables and benches of a laboratory and allowed to dry, they will crystallize, and, with the least movement of air, the place is filled with flying particles of chemicals. This is particularly troublesome in photographic dark rooms and laboratories, where such minute particles may settle upon the sensitive surface of plates and paper, generally resulting in spots of one kind or another; the developer or the sensitive material is then blamed, as the spots are usually indistinguishable until the plate or paper is developed.

Of course, in a laboratory of this kind, it is almost impossible to prevent the woodwork from being splashed with chemicals, but to prevent the absorption and subsequent crystallization, the benches and shelves should be waterproofed so that none of the liquid can be absorbed into the wood, and that it may be wiped up easily.

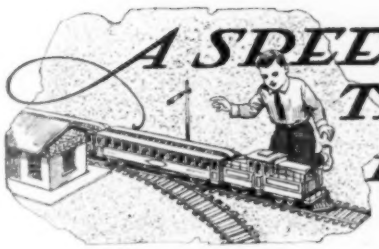
A simple method of waterproofing such woodwork makes use of paraffin wax. The wax is melted at as low a temperature as possible, and poured onto the wood. A warm flatiron, just hot enough to melt the wax, is used to rub the wax into the wood. The wood should be clean and dry before the wax is applied, and to make certain of this the surface should be sandpapered.

Insulating Radio-Aerial Mast

Being required, by a city ordinance, to insulate the mast supporting his wireless aerial from the roof, a wireless amateur with limited material and func solved the proble n in the manner indicated in the drawing.



A piece of 8-in. pipe and flange coupling were used as a standard to support the iron-pipe mast. The part forming the standard was 14 in. long and was secured in place by bolting it down. A layer of about 4 in. of broken glass and melted sealing wax was run into the bottom of the base, and after cooling, the mast was inserted, and the space between mast and base filled in the same manner.

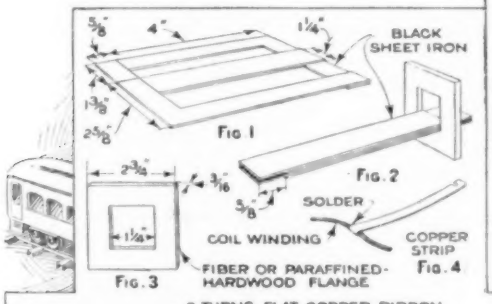


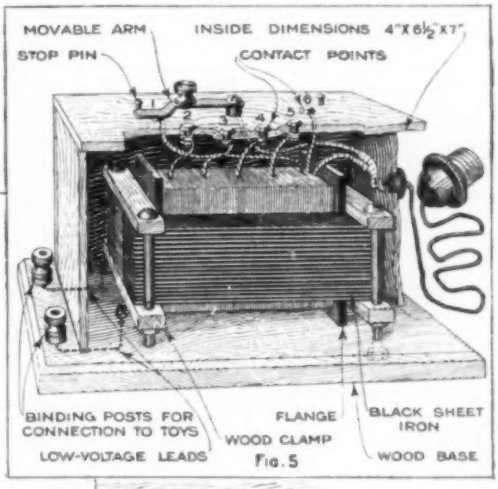
A SPEED-CONTROLLING TRANSFORMER FOR MODEL ELECTRIC TRAINS

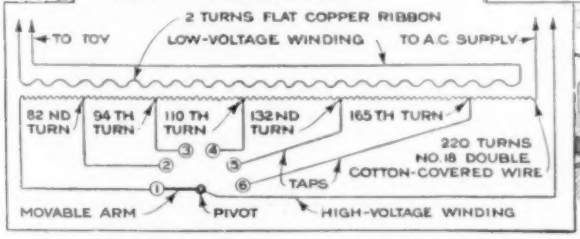
By A. H. SCOTT

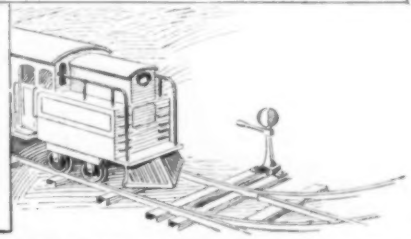
IN operating model railroads and other low-voltage appliances, a transformer is required for stepping down the usual 110-volt, 60-cycle alternating current to a suitable voltage.

Such a transformer is not difficult to make, and the materials required are not only easily obtainable but inexpensive. A quantity of black sheet iron is cut to the dimensions given in Fig. 1, to make the core. About 90 of the 1¼ by 4-in. pieces will be needed, and about 180 each of the L-shaped and small filling pieces will be necessary. The 1¼ by 4-in. pieces are assembled into a core, 1¼ in. square, the ends of the pieces overlapping each other ⅝ in. at each end, as in Fig. 2. The core thus obtained is tightly bound together with two layers of black friction tape, leaving ⅞ in. uncovered at each end. Make up two end flanges of fiber or paraffined wood to the dimensions in Fig. 3, and fit them tightly over each end of the core as in Fig. 2. The core is prepared for winding by shellacking on two layers of strong paper, which has been previously dipped in melted paraffin to make better insulation. The low-voltage winding consists of 12 turns of flat copper ribbon, ⅜ by 1/32 in. thick; this will occupy two layers and bring both ends out at the same end of the coil. If copper ribbon for the purpose cannot be obtained, soft sheet copper of the proper thickness can be cut into strips and soldered together to make a continuous piece, 6½ ft. long. The joints should be beveled for ½ in. before the pieces are soldered together, to make as smooth a job as possible. The entire strip is insulated with a single wrapping of thin cotton tape, which should be shellacked as it is wound on. No insulation will be needed between the two layers, as the tape gives ample protection. The ends of this winding are brought through a









An Easily Constructed Transformer for Model Electric Trains That will Enable the Youthful Engineer to Regulate the Speed of the Train at Will

slot cut in the adjacent end flange, a small piece of wood or fiber being placed between them at this point.

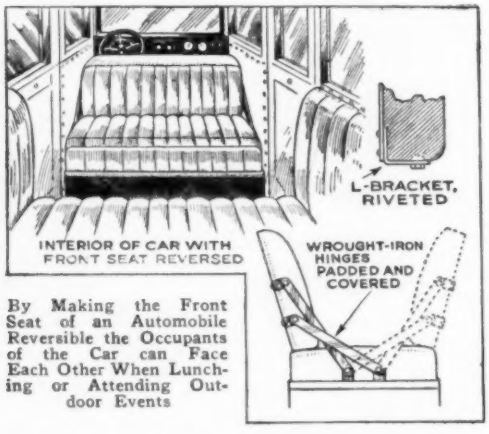
The low-voltage winding is covered with two layers of paraffined paper, which brings the builder up to the high-voltage winding. The latter winding is connected to the lighting circuit and consists of 220 turns of No. 18 gauge, double cotton-covered copper wire. It will occupy four layers. The start should be made at the end opposite the low-voltage terminals, and a single layer of paraffined paper should be placed between each layer of wire. Taps are taken off the high-voltage winding in the manner shown in Fig. 4, at the 82nd, 94th, 110th, 132nd, and 165th turns from the start. These taps should consist of thin copper strips, about ¼ in. wide, bent around the wire and carefully soldered, afterward insulating the joint and the tap with a wrapping of friction tape. All taps should be numbered in the order made for later connection in their proper order.

After the high-voltage winding is complete, the core is completely built up by using the L-shaped pieces in pairs and filling in the small gaps left at each end with the smaller pieces. The core is clamped together with fiber or hardwood strips drawn up tight with ¼-in. bolts, as in Fig. 5. It will be observed that the threads on these bolts are long enough to pass through the ⅜-in. hardwood base to which the transformer is bolted. A neat box of ⅜-in. stock is made, to inclose the transformer and serve as a base for the terminal board for regulating the voltage. A movable switch arm and a series of contact points which constitute the terminal board are "hooked up" to the high-voltage taps and supply line, as shown in the wiring diagram in Fig. 4, a suitable length of cord and plug being provided for attachment to the lighting circuit. The terminals of the low-voltage winding are brought to binding posts outside the box, where connection with the toy is made.

To start at slow speed, the switch arm should rest on contact 1, which passes 110 volts through the greatest number of turns and gives six volts through the low-voltage terminals. Moving the switch along the contacts until 6 is reached, 8, 10, 12, 14, and 16 volts are obtained. Twelve volts is the usual standard for small toys, but the 16-volt point gives a little extra speed without injury to the small motors.

A Reversible Automobile Seat

An eastern motorist has added something of novelty and convenience to his closed car by hinging the front seat so that it can be reversed to face the rear seat, when lunching in the car, attending games, and for similar purposes.

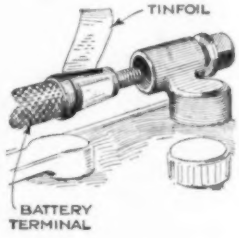


By Making the Front Seat of an Automobile Reversible the Occupants of the Car can Face Each Other When Lunching or Attending Outdoor Events

To do this, it was necessary to remove the seat back altogether and upholster the lower edge as well as the rear edge of the seat. The hinges, which are also the seat braces, are made of wrought iron and are of equal length; they are padded and covered with material to match the upholstery of the car. L-shaped brackets are riveted to each side of the seat and back, as indicated in the drawing, for attaching the hinges. The seat is reversed by pushing at the top, in the same manner as the seats in a trolley or railroad car are reversed.—G. A. Luers, Washington, D. C.

Repairing Loose Battery Terminals

It is sometimes found that the terminals of a storage battery are loose after the terminal nut is drawn as tightly as is possible without danger of stripping the thread. To leave the battery in this condition is almost certain to cause trouble, especially when the starting motor is cut in, as the loose connections will probably not pass sufficient current to work the motor properly, and the connection will heat.



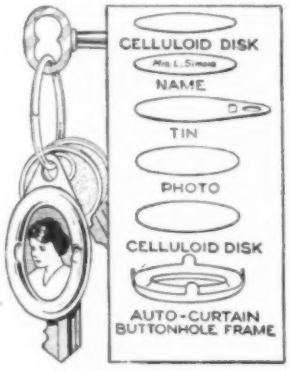
In such cases, the simple method illustrated can be used to insure a good contact. A suitable thickness of tinfoil strips is wrapped around the terminal, which is inserted in the post and tightened up in the usual manner, the tinfoil taking up the play.

Wallboard for Fret-Saw Work

At times there is considerable difficulty in obtaining suitable material for fret and jig-saw work. If the work is large, the difficulty is increased, as well as the expense. To form a panel or grille, and for many other purposes, ordinary wallboard can be used with results as satisfactory as those obtained by the use of wood. Wallboard is sufficiently rigid and waterproof for most purposes without extra bracing or treatment, but to insure against absorption of moisture, it can be given a coat of paint or varnish either before or after sawing.—A. C. Cole, Chicago, Ill.

Key-Ring Identification Tags

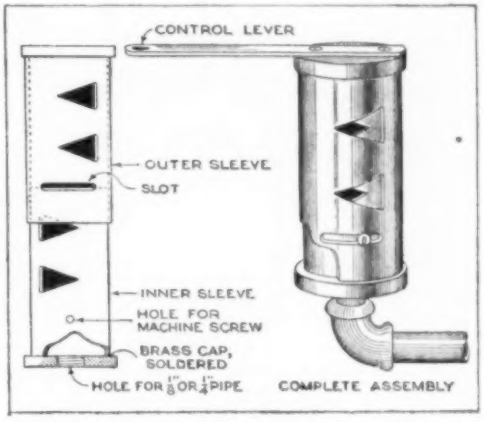
From the metal buttonholes used in connection with top-curtain fasteners in automobile work, it is possible to make neat frames that may contain the owner's name and address, photographs, etc., so that they can be conveniently carried on a key ring.



A celluloid disk is first placed in the buttonhole, then the disk of paper or cardboard on which the name is written, or photograph, as the case may be, and finally a piece of tin, which is cut with a projecting ear. A hole is punched in the projecting piece of tin to fit the key ring, and also a slot through which one of the ears of the metal buttonhole or frame is inserted and bent over. The three remaining ears on the metal frame are bent down over the edge of the tin and hold it securely in place. If desired, the arrangement may be as shown in the illustration, with a photo at the front of the frame, and the name, covered by another celluloid disk, at the back.—John Mignone, Spring Valley, Ill.

Auxiliary Air Device for Gasoline Engines

The auxiliary air device shown in the drawing can easily be made up out of



An Attachment for Admitting Additional Air to the Internal-Combustion Engine: It can Also be Used for Injecting Carbon-Removing Compounds

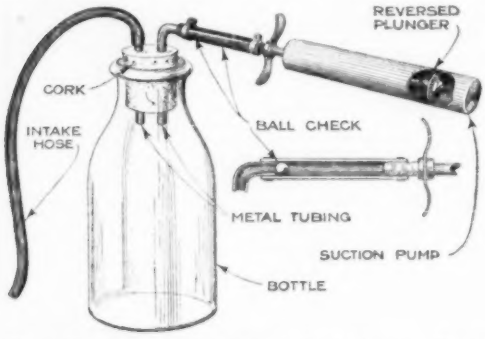
brass tubing, and works as well as, or better than, many of the high-priced commercial "gas savers." It is intended to be screwed into the intake manifold of an automobile, marine or stationary gasoline or kerosene engine, to admit an additional supply of air after the engine has warmed up. Though such a device should not really be necessary if the carburetor adjustment is theoretically correct, its use will often effect a noticeable saving of fuel, and furthermore, it offers a convenient means of injecting kerosene or liquid carbon-removing compounds into the cylinders.

Two short lengths of brass tubing, of such sizes that one will easily fit inside the other, are obtained, and a brass cap is soldered to one end of each, as shown in the drawing. The cap on the inner tube is drilled and tapped for a ⅛ or ¼-in. pipe nipple, depending on the size of the engine, and a brass control lever is screwed or soldered to the upper cap. Two or more elongated triangular slots, depending upon the amount of air to be admitted, are cut in the inner piece of tubing, or sleeve, and corresponding slots are filed in the outer sleeve, but pointing in the opposite direction, in the manner shown. This form of slot permits a gradual and easily regulated opening, as the outer sleeve is rotated about the inner one, which will be held fast by the pipe connection from the manifold. To prevent the outer sleeve from turning too far, it is slotted near the bottom, as

shown, and a round-head machine screw is put through into a suitable hole in the inner sleeve; this screw also permits locking of the device after correct adjustment has once been obtained.

Cleaning a Carburetor Float Chamber

In some six-cylinder automobiles no provision is made for draining the carburetor, or vacuum tank, without removing them or disconnecting the heating and feed connections and allowing the fuel in the vacuum tank to run off through the disconnected feed pipe. All this makes a lot of work and trouble merely to remove the few drops of water or particles of dirt that interfere with the operation of the carburetor.



When Draining the Contents of the Carburetor Float Chamber and Vacuum-Feed Tank of an Automobile, the Suction Device Illustrated Makes It Unnecessary to Disconnect the Float Chamber

The little device shown in the drawing will quickly draw all the fuel from the carburetor and vacuum tank without removing anything but the cover of the float chamber.

Two pieces of metal tubing are inserted through a tight-fitting cork, fitted into a quart bottle. One tube leads to a common type of small bicycle pump, in which the leather washer on the plunger has been reversed to produce suction instead of pressure. A BB-shot is dropped into the short rubber connection between the pump and bottle, to serve as a check valve.

By removing the screws holding the cover of the float chamber it can be lifted off, then the second rubber tube is inserted so that its end will reach the lowest part of the float chamber. Upon operating the pump, the contents of the carburetor and vacuum tank are sucked into the bottle without spilling a drop, and any water or particles of dirt that may be present will be brought along.

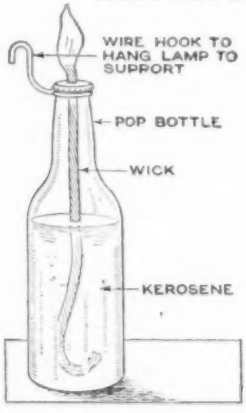
Sawdust as Kindling for Fires

When sawing the season's supply of firewood, a quantity of dry sawdust accumulates that is generally considered to be worse than useless, and in the same class with the accumulation of oil removed from the crankcase of the farm tractor. This oil has mixed with it some kerosene, considerable dirt and grit, and some water, all together making it unfit for lubricating purposes. However, by saturating quantities of dry sawdust with this waste oil, a shovelful of it in the kitchen stove makes an ideal kindling for starting the fire.

Much of it should not be prepared at one time, nor should it be kept in a confined place, as it becomes quite hot and may catch fire spontaneously. A metal container with a tight-fitting cover should be used for storing the oil-soaked sawdust; a quantity equivalent to about 5 gal. is sufficient for a month's use.—Geo. G. McVicker, North Bend, Neb.

A Camp Lamp Made from a Bottle

A kerosene lamp for the camp, or other purposes, is easily made from any bottle having a broad flat base, to prevent its being easily upset. If the bottle has been sealed with a crown cap, a ¼-in. hole for the wick is punched in the latter. The wick can be made of twisted cotton waste, or a piece of cotton cord, unraveled and loosely twisted. One end of the wick is passed through the metal cap, so that a small portion projects, and the other end is inserted inside the bottle, which is filled with kerosene. The bottle can be suspended by a wire hook around the neck, as shown in the drawing.—James P. Mooney, Washington, D. C.



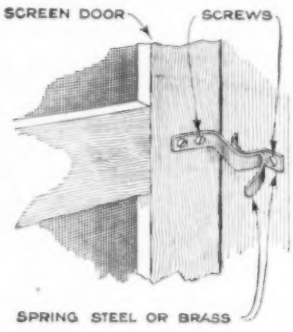
Protecting Dry Batteries

One of the prime reasons for the rapid deterioration of dry batteries is that they are attacked by moisture. If a battery can be kept dry, its life will be considerably prolonged. Where batteries are used

in damp places, such as motorboats, basements, etc., the following is a simple method of keeping the batteries at maximum efficiency for the longest possible time: Cut off a section of inner tube about a third longer than the individual cells. Close one end by vulcanizing, and slip the battery inside after having previously warmed it in an oven. Attach the terminal wires and either screw the nuts down solidly or else catch the wires with a drop of solder so that they will not become loosened. Tie the wires together with thread and then proceed to vulcanize that end of the tube, making a dampproof joint round the wires; applying a little cement to the wires where the edges meet will help in this. A common inner-tube vulcanizer is used.—L. B. Robbins, Claremont, Calif.

A Screen-Door Latch

A screen door provided with the catch shown in the drawing has a number of excellent features. It can be opened from either side; it will keep babies in and flies out, as it automatically catches when the door is slammed.



The catch is made of two pieces of spring steel, or brass. If steel is used, the temper is removed from the metal by heating, and the two pieces are cut, bent, and drilled for screws, as indicated, after which they can be retempered by heating to a dark red and plunging into water. The material used should be at least ½ in. wide, and before retempering, the catch should be tested out to find the correct angle for the bends.—A. D. Keogh, Springfield, Ohio.

Filing Phonograph Records

Phonograph records may be conveniently filed, without albums, by marking the title of the record on the open edge of the record envelope. This makes it possible to locate the selection wanted without handling more than one record at once, and in a minimum of time.—G. A. Tibbans, Galena, Kan.

Two Novel Bird Baths

The photograph shows two original ideas in bird-bath construction that can be adapted where it would not be possible to build a cement bath.

Two Original Designs for Bird Baths: The One at the Left is Made Entirely of Logs, a Cavity in the Top being Provided to Hold a Pan of Water. The Shingle-Covered Pedestal at the Right Supports an Enameled Tray

At the left is shown a bird bath made entirely from logs, a heavy cross section being used for the base, another for the top, and a few feet of a much smaller log forming the pedestal. The upper log section is hollowed out to receive a round pan which holds the water.

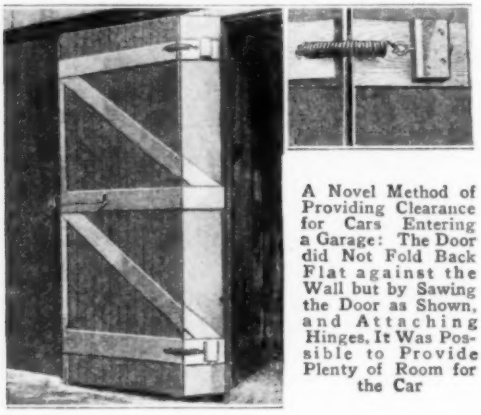
The shingle-covered bath at the right has a base made from 2-in. lumber, to which is fastened a tapered wooden frame, made of 1-in. strips, each side being 2 in. smaller at the top than at the bottom. A 2-in. cap, with a 1-in. board support for the pan, is provided.—C. L. Meller, Fargo, North Dakota.

Nonsliding Cooking Spoons

Spoons that are reserved for use in the kitchen can be easily prevented from sliding into the hot contents of a pot or pan by attaching a stop to the handle. A hole, about ⅛ in. in diameter, is drilled through the handle of the spoon at a convenient location, and a rivet, with the head on the upper side, is inserted and riveted underneath. The burr is finished off smooth and a shoulder is cut to engage with the edge of the pan, as shown in the small detail drawing.—J. Alexander, Lincoln, Neb.

A Novel Garage Door

Like many other garage doors, the one shown in the illustration refused to open



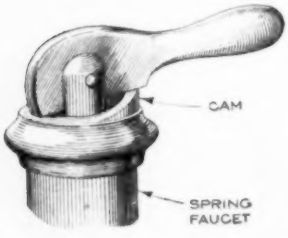
A Novel Method of Providing Clearance for Cars Entering a Garage: The Door did Not Fold Back Flat against the Wall but by Sawing the Door as Shown, and Attaching Hinges, It Was Possible to Provide Plenty of Room for the Car

far enough to permit the car to pass without striking it. As it was not possible in this case to rehang the door so as to permit it to fold back flat against the wall, a novel expedient was adopted.

The door was sawed in two lengthwise, as shown, and the two parts joined by additional hinges. A stout coil spring was attached, on the other side of the door, opposite each hinge. As a powerful leverage may be exerted upon the joint, it is not difficult to stretch the springs enough so that the door will open all the way. With this arrangement, a stop must, of course, be provided to prevent the door from swinging shut until released.—C. Ralston, Springfield, Ohio.

A Handy Faucet Attachment

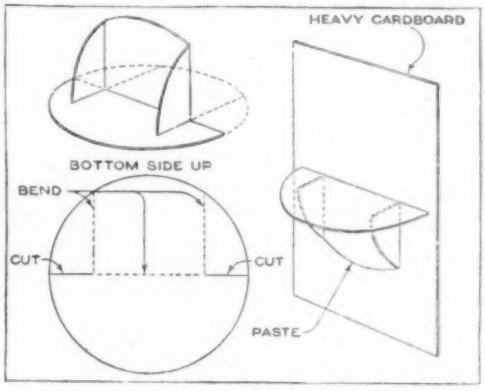
A spring faucet with a lever which is pushed down by hand is convenient because the maximum flow of water is immediately obtainable, and because careless persons are prevented from wasting the water. Such a faucet, on the other hand, is just as inconvenient when it is desired to allow the water to run to obtain a cool drink, or to draw any considerable quantity. A spring faucet of the type shown in the drawing may be made to give water continuously, without destroying its good qualities, by the addition of a simple and easily made cam.



The cam is made from a piece of sheet brass, in the form of an inclined plane, curved and soldered to the top of the valve in such a manner that if the lever is revolved about its axis it will ride up the incline and open the valve. A small flat should be provided at the top of the incline to prevent the lever from slipping down.—H. H. Raymond, New Haven, Connecticut.

A Simple Display Shelf

A neat display shelf for supporting light articles at various locations on the wall, or other vertical support, can be easily made from cardboard. A disk is cut to the desired size and along the heavy lines as shown. After the two cuts have been made, the parts are bent along the dotted lines, the semicircle forming the shelf.



An Easily Made Shelf for Displaying Small Articles: It is Made of Cardboard, Glued to a Suitable Back, and will be Found Very Useful to Druggists and Men in Similar Lines of Business

The support is then glued to an appropriate back.—C. A. Goddard, Los Angeles, California.

Wooden Pickle Tongs

A convenient pair of tongs for the removal of pickles from a barrel, or other container, is easily made by nailing the ends of two thin strips of hardwood to opposite sides of a small block. The prongs, being of light material, may be easily squeezed together at the open end in the same manner as a pair of tweezers. Such an instrument has the advantage over the usual ladles or forks that the pickles are thoroughly drained and cannot slip. Also, the tongs can be allowed to remain in the vinegar without rusting.

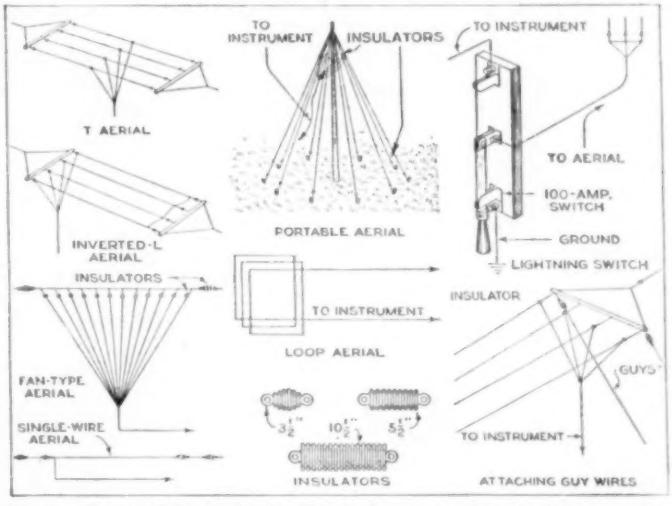
The Construction of Radio Aerials

By F. L. BRITTIN

MANY amateur radio operators try first one type of aerial and then another, a practice that is only a waste of time and money. Local conditions should be carefully studied, and an aerial of the type best suited for the location carefully built. Note particularly whether there are any high-tension transmission lines in the vicinity, and be careful that the aerial does not parallel them. If the station is for receiving only, an aerial of a single wire will answer the purpose; it should be about 100 ft. long, and ordinary porcelain cleats will answer for insulators. However, where the aerial is to be used for both sending and receiving, the insulation must be of the best, to prevent leakage of the high potential into surrounding metals and trees, and all long guy wires must be broken up into short lengths with insulators to prevent reradiation. Good insulation is imperative and must be given special attention. Several types of popular insulators are shown in the drawing; these insulators are made of a special composition and have a higher insulating efficiency than those made of porcelain.

A good transmitting aerial must contain from two to three wires, and when using the inverted L-type, the overhead wires must not exceed 100 ft. in length in order to keep within the 200-meter wave length. The T-aerial is the type generally used by commercial and marine stations, and in this case the length of the horizontal wires may be 130 ft., care being exercised to bring the lead in from the exact center. The fan type illustrated is one that is being used with excellent results by leading amateurs, while the portable aerial shown is the type used by the Signal Corps and the boy-scout organizations for field and outpost work, and is very good for short distances. The loop type of aerial, of which there are many varieties, is one of the most popular where an outdoor aerial is out of the question, as an aerial of this class can be used inside the house. The drawing also shows a method of guying an aerial to prevent it from being twisted in the wind. All guy wires should be thoroughly insulated, and if ropes are used to raise and lower the aerial, they should be coated with paraffin to prevent rapid deterioration due to exposure.

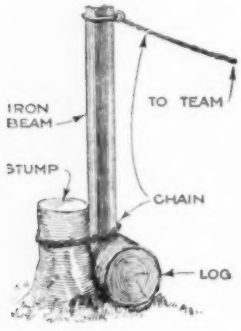
The best wire, in all cases, is stranded phosphor bronze, on account of its good conducting properties, but as this wire is rather expensive, No. 14 gauge bare copper wire is the amateur's favorite. Solder every joint, and have as few joints as possible. A few years ago it was thought that the higher the aerial was suspended the better; this has been found erroneous, and a height of 30 to 50 ft. is all that is necessary. In fact, a western amateur worked a station 1,000 miles away with his aerial suspended but 3 ft. above the roof of an apartment building. Bamboo poles for spreaders are recommended on account of their lightness and strength, although hickory, and similar woods, will usually be the most available. Use a lightning switch of 100-ampere capacity, placed on the outside of the building and as close as possible to the instrument table. This switch is necessary in order to comply with the fire-insurance rules, and all connections should be made as shown in the drawing, and soldered well. In bringing in the lead wire to the lightning switch care must be taken to keep it from contact with all trees, or metals such as drain pipes. The same precaution, of course, must be applied to all the other wiring in connection with the installation of the aerial if best results are to be obtained.



Various Types of Radio Aerials Easily Constructed by the Amateur: The Proper Arrangement of the Lightning Switch is Shown and the Correct Method of Guying T or Inverted-L Aerials

A Simple Stump Puller

In upper Wisconsin, where thousands of acres of cut-over timberland are being cleared for agricultural purposes, an easily constructed but powerful stump puller is being largely used with good effect.



The device resembles a huge mallet, with a log for a head and an iron beam, or piece of steel rail, for the handle, the purpose being to obtain increased leverage in pulling the stump. In use, the puller is chained to the stump in the manner shown in the drawing, and a team of horses is hitched to a chain attached to the extremity of the handle. The pull gives a rolling movement to the head that has a tendency to lift the stump, while the power of the team, applied to the handle as a lever, is greatly increased. A stump puller of this type is a very effective substitute for the horsepower capstan-type puller, excepting in the case of very large stumps.—Leo P. Cook, Marinette, Wis.

Decorating Celluloid in Colors

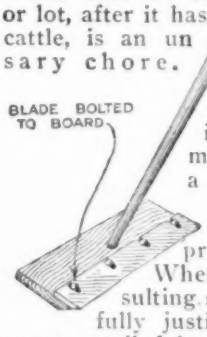
Articles of celluloid can be decorated by using colored solutions of celluloid dissolved in glacial acetic acid or amyl acetate. If the article to be decorated is ivory-white, the celluloid used for the solution should be dissolved in amyl acetate, which is another name for the so-called "banana oil."

To prepare the article, three parts of paraffin and one part of white wax are melted at a low temperature, and either painted or flowed over the surface to be worked upon. The design is then transferred to the wax coating; this is done by making the design on tracing paper and transferring it to the wax by following the outline with the point of a pencil or stylus, leaving the design indented in the wax. After removing the transfer, the wax is scraped from the parts to be colored with a sharp-pointed instrument, broad spaces being freed of wax with a sharp penknife. If several colors or shades are to be used, only the lines for one color are cut and that color applied; these lines are then stopped out with wax before the next color to be used is applied. To prepare the colors, small cuttings of colored celluloid are dissolved in either of the above-mentioned chemicals, using small wide-mouthed bottles. If colored celluloid is not obtainable, aniline dyes dissolved in alcohol can be added. The aniline dyes produce strong colors, while the solution made with the celluloid cuttings may not have as strong a color as desired, and more than one coat may be required to get the effect desired.

After the work has been completed, the wax can be easily removed from the article by rubbing with a soft rag and gasoline. The decoration obtained by this method is considered permanent, and, owing to the solvent action of the mixture, the applied work becomes practically a part of the article to which it is applied. —Bertha G. Morey, Ottumwa, Ia.

Manure Scraper from Planer Bit

The task of cleaning up the stable, or lot, after it has been occupied by cattle, is an undesirable but necessary chore. Hoes and shovels do the work rather slowly. The device shown in the drawing was made for the purpose, of a discarded planing-mill bit, bolted to a piece of heavy board, and provided with a handle. When put into use, the resulting saving in time and labor fully justified the time and expense entailed in making the device.—L. M. Jordan, Wallace, Ala.



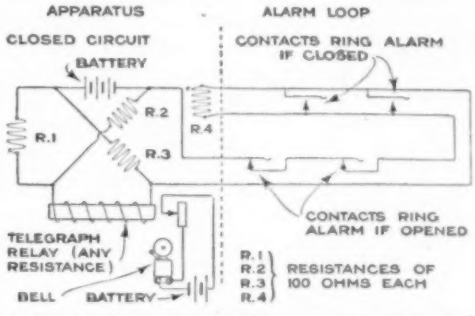
Bagging Needle Made from Can Opener

A bagging, or netting, needle can easily be made from a discarded can opener, or key. The handle is straightened, and the end formed to a spear-shaped point, as illustrated. The opening in the opposite end may be expanded to suit the size of twine used, the resulting needle being fully as useful as the manufactured article. A needle of this type will be found very useful to the farmer, and as he usually has quite a large supply of canned goods on hand, the opener is generally available, while a regular bagging needle is not always at hand when required.—J. H. Norrell, Augusta, Ga.

Burglar-Alarm Circuit

The burglar-alarm circuit shown in the drawing cannot be put out of order without giving an alarm. The only special apparatus required are a relay, which may be of most any type, four coils of equal resistance, and the closed-circuit battery.

With the alarm circuit completely connected as shown, the relay will remain inoperative because both sides of the battery, positive and negative, are connected to each end of the relay winding through equal amounts of resistance. The relay is in a neutral position with respect to the battery and receives no current. Now, should the side of the bridge forming the alarm loop become unbalanced, short-circuited, or broken, the current would flow through the relay winding, causing it to operate and ring the bell, or other alarm device.—C. M. Crouch, Minneapolis, Minn.



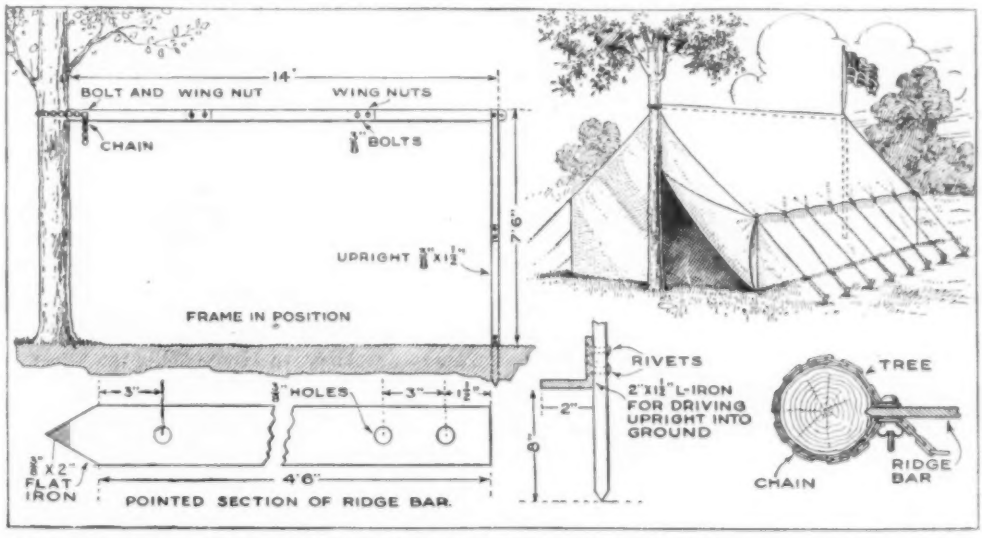
A Burglar-Alarm Circuit That cannot be Tampered With without Giving an Alarm; Short-Circuited or Broken Wires Cause the Bell to Ring

A Set of Folding Tent Poles

Motor tourists, and others who realize the necessity of traveling light, and with their tent and other equipment stowed away as compactly as possible, will appreciate the merits of the folding tent poles illustrated.

The poles are made of flat bar iron, cut into convenient lengths, and assembled by means of bolts and wing nuts. One section of the horizontal bar is sharpened at one end and provided with a suitable length of chain for holding it to a tree or post. The bottom section of the end pole is pointed and provided with an L-shaped piece, about 8 in. from the end, to serve as a stop, and to assist in driving it into the ground. After the supports have been assembled and erected, the tent is put up, pegged, and guyed in the usual manner. The bars should be given at least one coat of paint to prevent rust.

The same idea can be applied to the construction of a set of wooden poles if it is found undesirable to make use of the metal sections. However, in this case some form of slip or strap joint should be used so that it will not be necessary to make the ends of the sections overlap each other, which would make an unsightly joint in a wooden pole. The entrance to the tent may be made at either end.—P. P. Avery, Garfield, N. J.

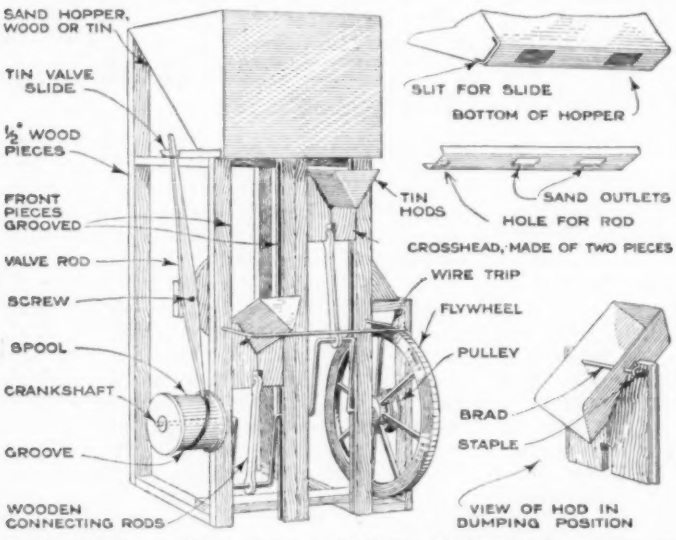


A Set of Sectional Tent Poles, the Value of Which is Realized by Motor Tourists and Campers Who must Travel with Their Equipment Stowed in the Most Compact Manner

Toy Sand Engine

A toy sand engine that will provide the amateur mechanic with some interesting applications of mechanical movements, and give endless entertainment to the children, can be made from a few easily obtained parts. The machine is operated by the weight of sand, which runs from the bin at the top into the hods. As only one of the hods is filled at a time, one of the crossheads and connecting rods is forced down alternately, the small flywheel preventing the device from stopping on a dead center. As the hod reaches the lowest point of its travel, one end of it comes into contact with the tripper, which overbalances the load and dumps the sand.

The hods are alternately filled with sand from the overhead bin by a slide valve, which, when the engine is started is automatic in action. The valve consists of a strip of tin with two openings which correspond to similar openings in the bottom of the bin. These openings are so spaced that when one hod is receiving sand, the opening on the opposite side is closed and the hod on that side is descending. The valve slides horizontally and is operated by a valve rod pivoted to a bracket on the frame. The valve is timed to open and close the sand openings by a grooved cam firmly secured to the end of the crankshafts. An old spool forms the basis for the cam, and an elliptical groove is cut into it large enough to take the end of the valve rod. The cutting and proportioning of this cam so as to have the slide valve open and close at the proper time will probably require more or less experimenting before the valve is properly "timed." The nearer the cam groove comes to the ends of the spool, the greater will be the travel of the valve rod. The upper end of the valve rod fits into a hole provided for it in the end of the slide valve. The valve should be "timed" so that it will remain open until the hod which is being filled with sand is halfway down. Also, the valve should be adjusted so that just before one hod is being tripped at the end of its travel, the other hod begins to receive sand.



A Toy Engine, in Which Some Well-Known Mechanical Movements are Applied: The Sand Hods are Automatically Filled from the Bin by a Slide-Valve Arrangement, Similar to That Used on Steam Engines

Testing Cylinder Pressure of Engines

A considerable part of the engine trouble experienced by automobilists is caused by poor compression in the cylinders. This condition may often be observed and recognized by a lack of reserve power, and difficulty in starting the engine quickly after it has stood idle for several hours. A simple little device can be made that will quickly indicate the cylinder having the low compression.

A rubber stopper, large enough to fit very tightly into the priming cups, should be obtained, and a hole drilled through its center. Next, fit into this hole the inlet tube of a tire-pressure gauge, care being taken to make an air-tight connection.

To test the compression of a cylinder, detach the spark connection so that the charge will not fire, and press the stopper into one of the priming cups. It may be necessary to wire the stopper to the cup to insure a tight connection. Start the engine, and while it is running idle, turn the primer cock so that the cylinder gas will enter the gauge under full pressure at each upstroke of the piston. Note the gauge reading; test each cylinder in turn, and a comparison of the readings will indicate which cylinder is causing the trouble.

PRIZE OFFERS

HUMANE ASSOCIATION OFFERS PRIZES FOR ESSAYS ON CRUELTY OF TRAPPING

Hundreds of thousands of fur-bearing animals are trapped each year, most of them in the midst of winter. The trapping is done in a manner that involves an immense amount of avoidable suffering to the trapped animals, which frequently die from cold, starvation, or assault from their natural enemies before the trapper comes around to gather in his spoil. In order to ameliorate this suffering the American Humane Association is offering prizes, aggregating $300, for the best essays showing the cruelty of trapping, and suggesting remedies for it. The prizes are divided as follows: a first prize of $100, a second of $75, a third of $50, besides two special prizes of $50 and $25 each which are offered to persons under 20 years of age, preferably in schools and colleges. All essays are to become the property of the association. They are not to exceed 2,500 words in length, and are to be plainly typewritten on one side of typewriting paper, and mailed flat. Essays are to be signed with a motto, or some fictitious title, and are to be accompanied by a sealed envelope inclosing the writer's real name and address. Besides the plain unrhetorical relation of the cruelties incidental to trapping, and the suggestion of remedies for these conditions, it should be shown that our government has predicted the total extinction of many varieties of animals if the present rate of destruction is permitted, and has recommended that fur farms should be encouraged for their conservation. The contest closes at 6:00 p. m., Dec. 31, 1921. Address the American Humane Association, Albany, New York.

MEDAL TO BE AWARDED ANNUALLY BY ACETYLENE ASSOCIATION

A medal, to be awarded at each convention of the International Acetylene Association to the writer of a paper or maker of a report which is deemed to be of most value to the industry, has been established, and is dedicated to the memory of the late Major J. Turner Morehead, pioneer in the carbide and acetylene business. The association has had a diploma designed, and a die made from which one medal will be stamped for each convention. Any person taking part in the program of the convention will be eligible, whether a member of the association or an invited guest, and whether an American or a foreigner, appearing in person or sending a paper to be read by proxy. At each convention a committee will be appointed to consider the papers delivered at that convention, and it will make a report to the officers prior to the succeeding meeting of the association. Thus the officers will be enabled to have the medal and the diploma ready for presentation to the winner at the following convention. The next annual meeting of the association is October 4, 5, and 6, in New York City.

PRIZES OFFERED FOR BEST PHOTOGRAPHS FOR NEWSPAPER REPRODUCTION

A prize competition for photographers is being conducted by the New York Evening Post. Photographs, preferably of subjects of unusual character, or of unusual treatment of well-known subjects, interior views being not desired, will be reproduced in the rotogravure section of the Evening Post, and will then be returned to the owners, who retain the copyright. Prizes will be awarded as follows: monthly, a 1st prize of $15, a 2nd prize of $10; on October 1, prizes for the entire contest: 1st, $50; 2nd, $25; and 3rd, $15; The contest closes September 30. Address: Graphic Section, Evening Post, 20 Vesey Street, New York City.

ILLINOIS AND INDIANA NOW IN CONTEST SELLING U. S. SAVINGS CERTIFICATES

The two states Illinois and Indiana are now engaged in a contest in which the winner will be the state that sells the larger amount of government savings securities. At the time of the inauguration of this contest, on August 1, both states had made a very exceptional showing, as compared with other states, in the purchase of these securities. From figures issued by the Treasury Department it appears that Indiana had a greater per-capita purchase, but Illinois, with a larger population, had a larger total purchase. The contest will be conducted by the postmasters of the two states, who will work actively to push the sales of all issues of savings certificates. The period of the contest is four months, closing November 30, this year.

WOODROW WILSON PRIZES TO BE AWARDED FOR DISTINGUISHED PUBLIC SERVICE

From a fund of $1,000,000, or more, to be raised by public subscription by the Woodrow Wilson Foundation, prizes will be awarded for meritorious service to democracy, public welfare, liberal thought, or peace through justice. Franklin D. Roosevelt, national chairman of the executive committee, has announced that the committee to decide the periodic awards will be representative of all classes and interests in the United States, and that the intention is to establish a nonpartisan and nonpolitical institution to make these awards an expression of the gratitude of the American people for distinguished public service in the promotion of liberal progress.

PRIZES GIVEN FOR SUPPLYING THE BEST MISSING FIFTH LINE IN A LIMERICK

Five-line nonsense verses, known as limericks, with the fifth line omitted, are to form the subject of a contest in every issue of the New York City Sunday News. Cash prizes to the value of $500 will be awarded for the best last lines to complete the rime. The first three prizes are $200, $50, and $25, respectively, and there are 45 prizes of $5 each for the next best lines. The contest is open to everyone without any regard to residence. The limerick is printed inside a large square coupon on a page of the paper, with spaces for the last line, and for the competitor's name and address. The use of the coupon is not compulsory. In case of ties, the full sums offered will be awarded to each contestant. All answers to the limerick must reach the Sunday News office not later than 6:00 p. m. on the Wednesday following the Sunday on which the limerick is published. The prize winners will be announced the following Sunday.

THE ELLEN RICHARDS RESEARCH PRIZE FOR A THESIS BY A WOMAN

For the best thesis written by a woman on a scientific subject the Ellen Richards Research Prize of $1,000 is offered by the Association to Aid Scientific Research by Women. The thesis must embody new observations and new conclusions based on independent laboratory research. Papers published as a whole before Jan. 1, 1920, are not eligible. The thesis must be written in English. The title page must bear an assumed name, and the manuscript should be accompanied by a sealed envelope containing the application blank superscribed with this assumed name. Theses must reach the committee before Feb. 25, 1922. For further information and application blank address Dr. Lilian Welsh, Goucher College, Baltimore, Md.

ASSISTANT MECHANICAL ENGINEERS WANTED IN U. S. CIVIL SERVICE

The U. S. Civil Service Commission announces an open competitive examination for assistant mechanical engineers to fill vacancies in the Bureau of Public Health Service, Washington, D. C., at salaries ranging from $2,500 to $3,000 a year, according to the qualifications of the appointees. All citizens, both men and women, who have reached their 25th birthday but not their 50th, may enter the examination, but it is optional with the bureau to appoint men where preferred. The field duties consist of the supervision, installation, and inspection of plumbing, heating and electrical equipment in hospitals, and of water supply and sewage disposal upon reservations.

Competitors without having to report at any place for examination will be rated as follows: general and technical education, 30 per cent; responsible experience and fitness, 70 per cent; these ratings being based upon competitors' sworn statements, and upon corroborative evidence. All desirous of competing should

at once apply for Form 1312, stating that the examination is for Assistant Mechanical Engineer, to the Civil Service Commission, Washington, D. C., or to the Secretary of the U. S. Civil Service Board in the applicant's locality. All applications must be received by September 30, this year.

SHIPPING BOARD OPENS NEW OFFICE AT ST. LOUIS, MISSOURI

With the object of establishing a closer contact with the shippers of the central states, the U. S. Shipping Board has opened a new office at 705 Liberty Central Trust Building, St. Louis, Mo. Shippers are asked to apply to this office at all times for any information regarding ocean rates, trade routes, and the facilities of the merchant marine at all ports. The shipping board's representatives will not engage in the actual bookings of export tonnage, but will arrange for bookings through representatives of American vessels at any port. At the present time the shipping board has a grand total of 440 general-cargo trade routes, of which 417 are between the United States and foreign ports, 9 between United States ports, and 14 between foreign ports. On these 440 trade routes, 548 general-cargo services are maintained. The board's operating fleet, which makes possible the continuation of these general-cargo services, now consists of 1,708 vessels of an aggregate of 11,046,780 tons. American shippers are urged to take advantage of the facilities offered by this new office, and to aid in the maintenance of the new merchant marine by specifying in their bills of lading the use of American-flag vessels.

EXPOSITION TO BE HELD IN MEXICO TO PROMOTE TRADE WITH THE UNITED STATES

A great international exposition is to be held in Mexico City from September 12 to October 12, this year, with the object of promoting a closer commercial relationship between the United States and Mexico. The exposition is to be known as the "Exposición Comercial Internacional del Centario," because this is the one-hundredth anniversary of the freedom of Mexico. The enterprise is under the auspices of the Mexican government and all the chambers of commerce of that country. Exhibits shipped from this country will be admitted into Mexico free of all duties, and will be transported from the border to Mexico City without any freight charges. To obtain these advantages exhibits should be sent to Laredo or El Paso, Texas.

PRIZES FOR BEST PHOTOS AND PLANS OF ALL-SHINGLED HOUSES

In both the United States and Canada the red-cedar shingle manufacturers offer 12 cash prizes amounting to $1,000, in graduated reductions from $250 for the 1st prize to $25 for the 12th, for photographs and plans of the best designed all-shingled houses submitted on or before Nov. 1, 1921. Contestants may be home owners, builders, contractors, lumber dealers, or architects residing in the United States or Canada. The houses submitted are to contain not less than five and not more than eight rooms with bath. Exterior walls and roof are both to be covered with shingles. Photos must be printed on smooth-finished paper, 7 by 11 or 8 by 10 in. in size. Floor plans may be roughly drawn, but must have dimensions of each room clearly shown in ink. Each photograph and plan must have name and address of sender written in ink on its reverse side.

On a third sheet of paper answers must be written to the following questions: Date house was built? Name of architect or contractor? What kind of shingles used? (Name of wood.) What grade and thickness? Exposure to weather on roof? Exposure to weather on side walls? How treated—stain or paint? Kind of nails used? Has your roof ever been reshingled? Reasons why you prefer an all-shingled house?

Any local lumber dealer or builder can be applied to for help on the technical parts of these questions.

Address in U. S., Shingle Branch, West Coast Lumbermen's Association, Henry Building, Seattle, Wash.; in Canada, Shingle Manufacturers Association of British Columbia, Metropolitan Building, Vancouver, B. C.

CONTESTS PREVIOUSLY ANNOUNCED

Students of Railroad Engineering: Scholarships; announced March issue, 1920; closes Dec. 31; offered by the Southern Pacific.

Essays on the Life of Roosevelt: Scholarship prizes valued at $1,000, $750, and $500; announced August issue, 1920; closes Dec. 31; address, Woman's Roosevelt Memorial Association.

New Methods of Testing Hardness of Metals: Prize $1,000; announced October issue, 1920; closes Jan. 1, 1922; address, Institution of Mechanical Engineers, London, England.

Piano and Strings Quintet by an American Composer: Prize $500; announced July issue, 1921; closes Nov. 1; address, M. Gobert, 4 W. 130th St., New York City.

Painless Animal Trap: Prize $500; announced May issue, 1921; closes Oct. 1; address, American Society for the Prevention of Cruelty to Animals, New York City.

Essays on Economics: Prizes, $1,000 and $500; announced June issue, 1921; closes Dec. 31; address, Dr. Wm. T. Foster, Newton 58, Mass.

Medals, Diplomas, and Money Awards: Announced August issue, 1921; awards offered by the Franklin Institute.

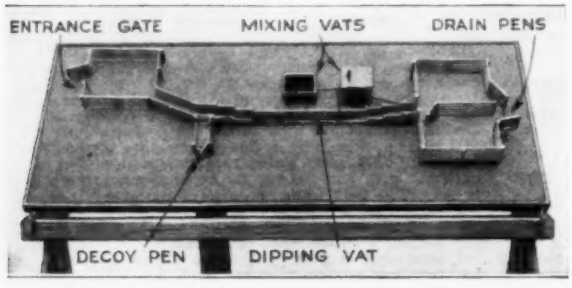
Essays on Contributions of Jews to Hygiene: Prize $1,000; announced August issue, 1921; closes Nov. 1, 1922; address Jewish Publication Society of America, 1201 North Broad St., Philadelphia, Pa.

For Service to the City of Philadelphia: Prize $10,000; announced September issue, 1921; awarded in spring or summer of 1922 by Edward Bok, former editor of The Ladies Home Journal.

Orchestral-Composition Contest: Prize $1,000; announced September issue, 1921; closes, Jan. 1, 1922; address, Carl D. Kinsey, 624 S. Michigan Ave., Chicago, Ill.

Safety-First Essays: Prizes, a trip to Washington and gold watch, a gold loving cup, a silver loving cup, and other state prizes; announced September issue, 1921; closes late in the fall; address any public-school teacher.

NEW SHEEP-DIPPING PROCESS SHOWN BY MODEL



A Miniature Sheep-Dipping Arrangement, Built by the United States Department of Agriculture to Demonstrate a New System for That Work

An interesting miniature of a sheep-dipping outfit that is a model of a new system for carrying on this work, has been built by the Department of Agriculture. The dipping vat in the model is located between two pens, one for the entry of the sheep and the other for use as a corral while they are freed of the excess solution left on them after the dip. A sheep imprisoned in a small pen at the entry to the dipping vats, decoys the rest to enter.